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DATA PROCESSING PLAN
INTERPLANETARY MONITORING PLATFORM-F
IMP F

VOLUME I: THE SPACECRAFT

VOLUME II: THE DATA PROCESSING'

JULY 1967

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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VOLUME I: THE SPACECRAFT

JULY 1967

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

DATA PROCESSING PLAN
FOR
INTERPLANETARY MONITORING PLATFORM
(IMP F)

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LIST OF EFFECTIVE PAGES

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DATA PROCESSING PLAN

INTERPLANETARY MONITORING PLATFORM

IMP F

FOREWORD

This Data Processing Plan records the methods and procedures to be used to process analog telemetry data received from the IMP F spacecraft. The data will be digitized and decommutated following the methods and procedures listed herein by the personnel of the Information Processing Division, Goddard Space Flight Center.

The plan is presented in two volumes — Volume One describes the spacecraft and its mission; Volume Two describes the data processing methods and procedures.

All questions regarding changes, corrections, or revisions to this document should be directed to Mr. Harold H. Levy, Assistant Branch Head, Processor Development Branch, Information Processing Division — Building 23, Room C-225. X-4593.

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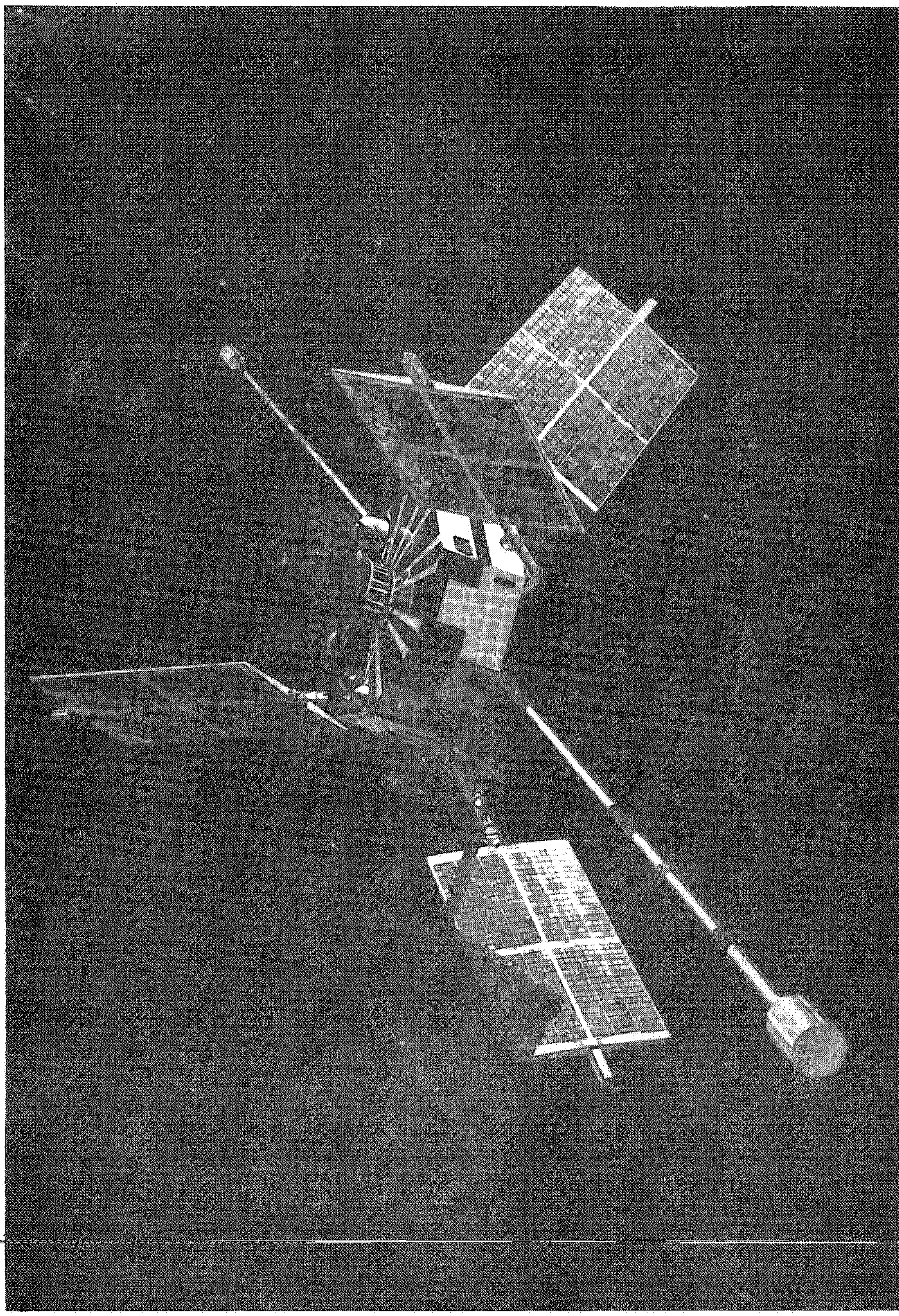


Frontispiece — Interplanetary Monitoring Platform (IMP F and G)

VOLUME ONE

THE SPACECRAFT AND ITS MISSION

1. SCOPE

This Data Processing Plan defines the technical aspects of the information processing system designed to reduce and analyze telemetry data received from the Interplanetary Monitoring Platform spacecraft (IMP F) in order to provide the experimenter with accurate data from his experiment in as short a time as possible.

The plan is presented in two volumes - Volume One provides a general description of the spacecraft and its mission; Volume Two provides detailed descriptions of the data processing equipment, methods, and procedures.

2. OBJECTIVE

The mission of the IMP F spacecraft is to obtain data on solar and galactic cosmic radiation, solar plasma, energetic particles within the magnetosphere and its boundary layer, and the interplanetary magnetic field.

The launch will be from the Western Test Range (WTR). The spacecraft will have an earth orbit of high eccentricity (nominal apogee 200, 000 kilometers and perigee 200 kilometers), perpendicularity of the spin vector to the ecliptic, and an operational lifetime of twelve months.

3. TRACKING AND DATA SYSTEMS (T&DS) CADRE AND KEY PERSONNEL

PROJECT MANAGER

The Project Manager, Paul Butler, is responsible for assuring performance of all functions necessary for management of the IMP F project. He discharges his responsibilities with the assistance and support of the personnel listed in the following paragraphs. The Assistant Project Manager, Benjamin H. Ferer, assists the Project Manager in the performance of all: functions of the IMP F management.

PROJECT SCIENTIST

The Project Scientist, Frank B. McDonald, is responsible for ensuring that maximum information is obtained from the IMP F spacecraft consistent with the experimental objectives of the mission.

TRACKING AND DATA SYSTEMS MANAGER (T&DSM)

The T&DSM, Thomas C. Moore, is a member of the project staff representing the T&DS Directorate. He manages the ground support effort to ensure that the Ground Tracking and Data Acquisition systems meet mission requirements and is responsible for overall utilization of all T&DS facilities.

TRACKING SCIENTIST

The Tracking Scientist, Curt Stout, is a member of the T&DS Directorate assigned to the project staff as an overall technicaladvisor on ground systems. He is responsible for defining optimum modifications or augmentation of the ground system to provide full system integrity.

TRACKING AND TELEMETRY ENGINEER (TATE)

The TATE, George C. Kronmiller, of the Network Engineering and Operations Division coordinates the design, engineering, construction, and integration of the ground equipment. He establishes the necessary tests, simulations and procedures to ensure an operational ground system.

CONTROL CENTER OPERATIONS MANAGER (CCOM)

The CCOM, Richard A. Schumacher, of the Project Operations Branch directs the operation and maintenance of the control center.

DATA PROCESSING ENGINEER (DPE)

The DPE, Harold H. Levy, of the Information Processing Division (IPD) manages the IPD's telemetry data processing mission support effort and works with the individual experimenters to determine the most useful form of individual output.

ORBITAL COMPUTATIONS ENGINEER (OCE)

The OCE, David J. Stewart, of the Data Systems Division manages all orbital and support computing operations.

COMMUNICATIONS ENGINEER (CE)

The CE, Leonard Stewart, of the NASA Communications Division coordinates the design, procedures, implementation and testing of mission-unique communications.

4. IMP F PROJECT EXPERIMENTS

4.1 OBJECTIVES

The detailed study of solar particle emissions is the major scientific objective of IMP F. The experiment complements will provide comprehensive measurements of the intensity, energy spectra, charge spectra, and arrival direction of solar cosmic rays in the cislunar region. To accomplish this objective, the spacecraft contains the following experiments:

EXPERIMENT	AFFILIATION	COMMAND DESIGNATION*
1. Low-energy Telescope	Bell Telephone Laboratory	BTL
2. Ion Chamber	University of California	U. Cal
3. Range versus Energy Loss	University of Chicago	CHI
4. Low-energy Proton and Electron Differential Energy Analyzer (LEPEDEA)	University of Iowa	U of I
5. Cosmic Ray Anisotropy	Graduate Research Center	GRC
6. Spherical Electrostatic Analyzer	TRW Systems	TRW
7. Solar Proton Monitoring	GSFC & APL	APL
8. Plasma Experiment	GSFC & University of Md.	GUM
9. Low-energy Proton and Alpha Detector	GSFC	CRT
10. Energy versus Energy Loss	GSFC	CRT
11. Magnetic Fields	GSFC	MAG
12. Radiation Effects on MOSFETS (Engr Exp)	GSFC	Not Commanded

*See Section 9

5. SUMMARY DATA, INTERPLANETARY MONITORING PLATFORM (IMP F **AND** G)

General

Weight: 158.2 pounds

Shape: Octagonal

Size: Height: 10 inches
Diameter: 27 inches
Paddles, tip to tip: 8 feet
Booms, tip to tip: 13.5 feet

Launch

Date: 1967 (second quarter) IMP F
1968 (second quarter) IMP G

Facility: Western Test Range

Vehicle: Thrust Augmented Improved Delta (TAID), DSV-3E with FW4 third stage

Basic orbit parameters are: Apogee: 122,000 n. m.
Perigee: 140 n. m.
Inclination: 66.5 degrees
Period: 4 days
Injection above the equator at the proper time places spin axes perpendicular to the ecliptic.

Experiments **(11)**

Weight: 50.7 pounds

Power required: 15 watts

Energetic particles (7): Bell Telephone Laboratories
University of California
University of Chicago
Southwest Center for Advanced Studies
Applied Physics Laboratory/GSFC
Goddard Space Flight Center (2)

Plasma (1): Goddard Space Flight Center/University of Maryland

Energetic particles and plasma (2): University of Iowa
TRW Systems Group, TRW Inc.

Magnetic fields (1): Goddard Space Flight Center

Power System: 6144 n-p solar cells with 6 mil glass covers on 4 paddles supply a nominal average of 70 watts and a minimum after 1 year of 47 watts; 5 ampere-hour capacity silver-cadmium battery pack operates spacecraft for up to 2 hours. Pre-boost regulator supplies 1-28 vdc and +11vdc to subsystems at 80 to 90 percent efficiency. Total spacecraft power required is 35 watts average and 40 watts peak.

Optical Aspect: Sun and earth sensors determine spin axis-sun angle, spin rate, and spin-axis orientation; also provides sectoring of the spin period for experiments.

Command System: Total commands - 29 including Experiments off (11)
Experiments on (11)
RARR
RARR defeat
Transmitter off
Transmitter on
Fire TRW squibs
Mag low range
Mag high range

Encoder and Digital Data Processor: PFM, burst-burst, 100 bits/second, all data digital, 16-level crystal controlled frequency synthesizer, DDP capacity 451 bits (4x IMP 1), MOSFET logic design, on-board clock telemeters a unique number twice per sequence (20.48 seconds), recycles to zero every 15-1/2 days. System weighs 14.8 pounds, requires 2. 5 watts, and includes 7 pounds of shielding.

Telemetry: Carrier frequency **136.140** MHz for IMP F, RF output **4** watts, modified turnstile antenna, diplexer coupled to transmitter and two command receivers. RARR tracking data on command.

Tracking and Data Acquisition: STADAN

Tracking (interferometer) and data acquisition stations:

Johannesburg, South Africa
Orroral, Australia
Santiago, Chile*
Quito, Ecuador
Lima, Peru
Fairbanks, Alaska
Winkfield, England
St. Johns, Newfoundland
Tananarive, Republic of Malagasy*
Ft. Myers, Florida
Rosman, North Carolina (no interferometer)

STADAN range and range-rate tracking stations:

Tananarive, Republic of Malagasy
Santiago, Chile
Carnarvon, Australia
Rosman, North Carolina
Fairbanks, Alaska (when operational)

6. ORBIT

A primary scientific requirement for the IMP F mission is to place and maintain the satellite's spin-axis normal to the sun. This perpendicularity permits optimization of the three plasma experiments by reducing the acceptance angle of the sensors and of the two measurements of solar cosmic ray anisotropy.

*Stations equipped with pulse-frequency modulation data handling equipment (PFM/DHE) for decommutation of spacecraft data.

Spacecraft engineering is also enhanced by this attitude requirement; the passive thermal control and the solar array arrangement can be optimized for a nearly constant sun angle.

To achieve the spin axis-sun angle perpendicularity, two approaches were considered, since a conventional IMP trajectory (i.e., IMP's 1 through 3) could not satisfy the attitude requirement. First, an onboard attitude-control system employing sublimating solid rockets for alignment of the spin axis, and secondly, a unique orbit which would meet the mission requirements by proper choice of inclination, injection coordinates, and launch hour.

For the initial IMP launch, the second was chosen, primarily because it met the requirement without increasing the cost or complexity of the spacecraft design. Since this orbit will have an initial inclination of 66.5 degrees, it will also afford an opportunity to investigate higher latitudes during perigee passes.

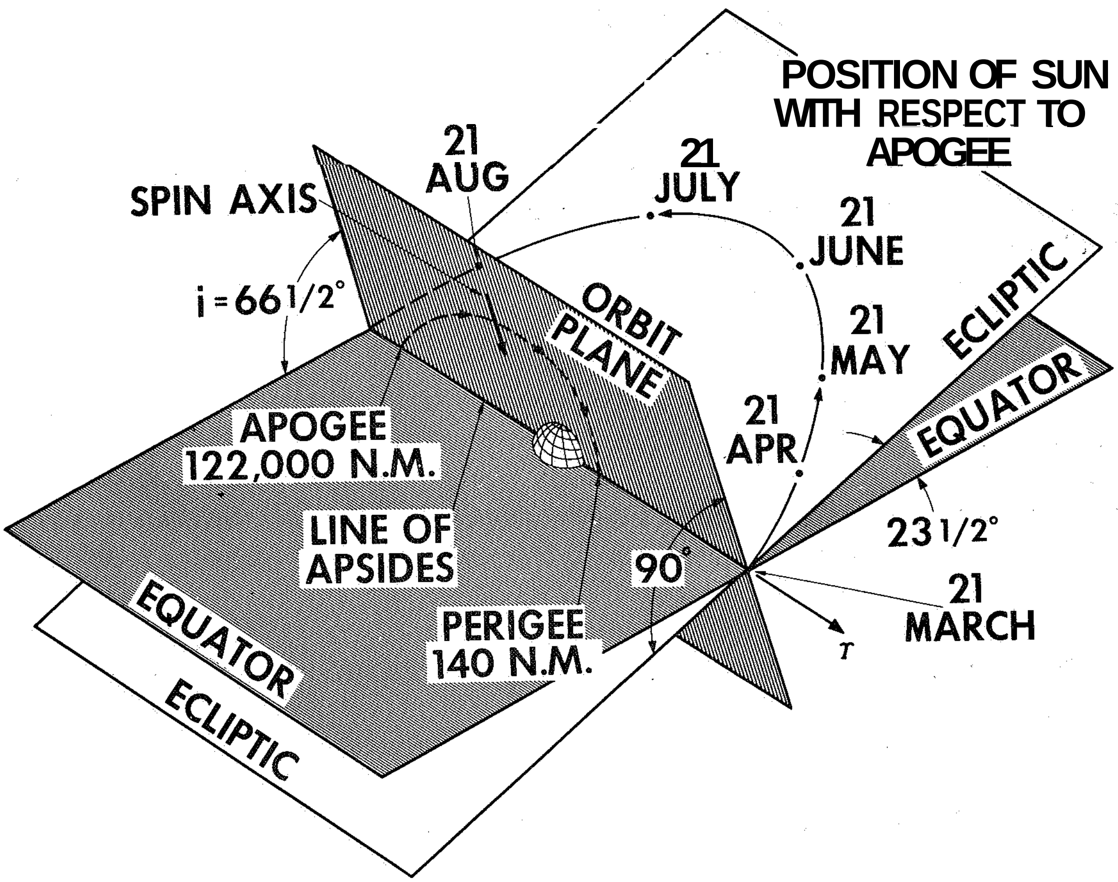
Injection into this orbit could be achieved from either test range, but range safety requirements make WTR the more logical choice at this time. For later IMP missions it may be advisable to incorporate an attitude-control system, since it would permit an ETR launch (and an associated weight capability) and vernier corrections to the spin axis-sun angle as needed throughout the spacecraft mission.

The IMP F orbit (shown in Figure I-1) has the following characteristics:

Apogee:	30 earth radii (122,000 n. miles)
Perigee:	140 n. miles
Period:	4 days
Inclination:	66.5 degrees to equator
Injection:	0 degree latitude, 110 degrees W. Longitude
Line of apsides:	Apogee directed toward the autumnal equinox
Launch window:	30 minutes, most days

Shadows:

Perigee:	25 minutes maximum per orbit
Apogee:	10–12 hours, occurring once in late March
Spin axis–sun angle:	90 ±5 degrees
Lifetime:	12 months minimum



Note: Injection at Equator at ~110° W, Launch Time Selected to Place Apogee Toward the Autumnal Equinox.

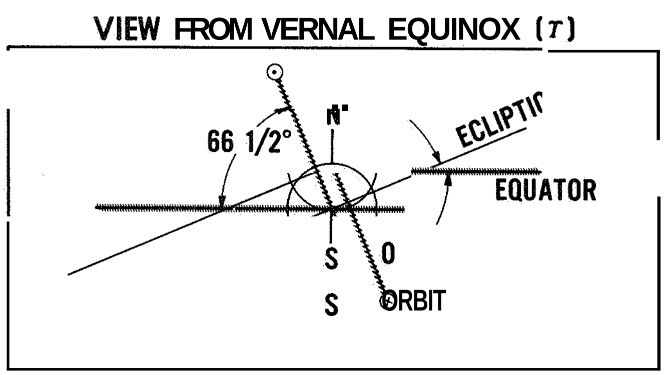


Figure I-1 – Proposed Orbit, IMP F

7. SPACECRAFT

7.1 STRUCTURE

The IMP F structure (Figure 1-2) is similar to that of earlier IMPs, but with improvements and modifications based on advances in the state-of-the-art, and new spacecraft requirements.

The structural assembly consists of six major items or groups of items:

1. Center tube - A through-section of machined magnesium about 8 inches in diameter providing the attachment interface with the Delta third-stage motor and enclosing the silver-cadmium battery pack and GSFC energy vs energy loss (E vs dE/dX) telescope.

2. Platform - An octagonal aluminum honeycomb platform providing support for the experiments, spacecraft electronics, and the harness support.

3. Harness support - An octagonal aluminum honeycomb wall providing support for the electrical wiring harness and mating connectors.

4. Top cover - An octagonal aluminum honeycomb walled enclosure providing thermal control surfaces, RF shielding, and mechanical support of special thermal and RF shields.

5. Appendages - There are six, all of which are spring loaded and deployed following injection into orbit; two 6-foot fiberglass double-hinged booms supporting the fluxgate magnetometers, and four arms to which the solar paddles are attached.

6. Struts and brackets - Eight aluminum assemblies which carry launch and appendage erection loads from the outer edge of the platform to the center tube.

The experiments and electronics are packaged in trapzoidal-shaped modules grouped in eight stacks and located on the periphery of the platform providing a high roll moment of inertia.

The placement of experiments and assemblies in the eight facets of the octagonal platform (Figure 1-3) was determined based on the following factors:

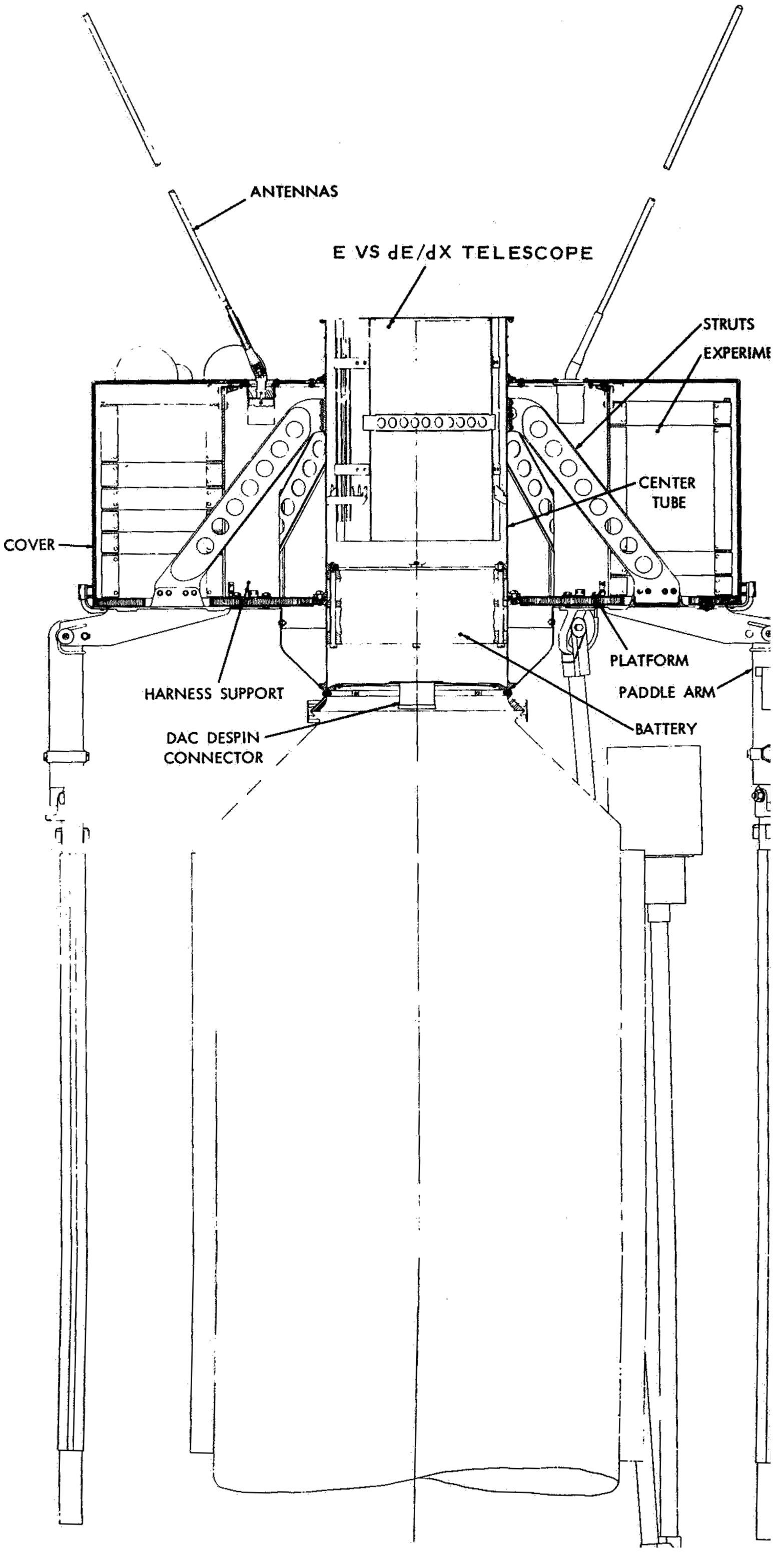


Figure I-2 – IMP F and G Structure

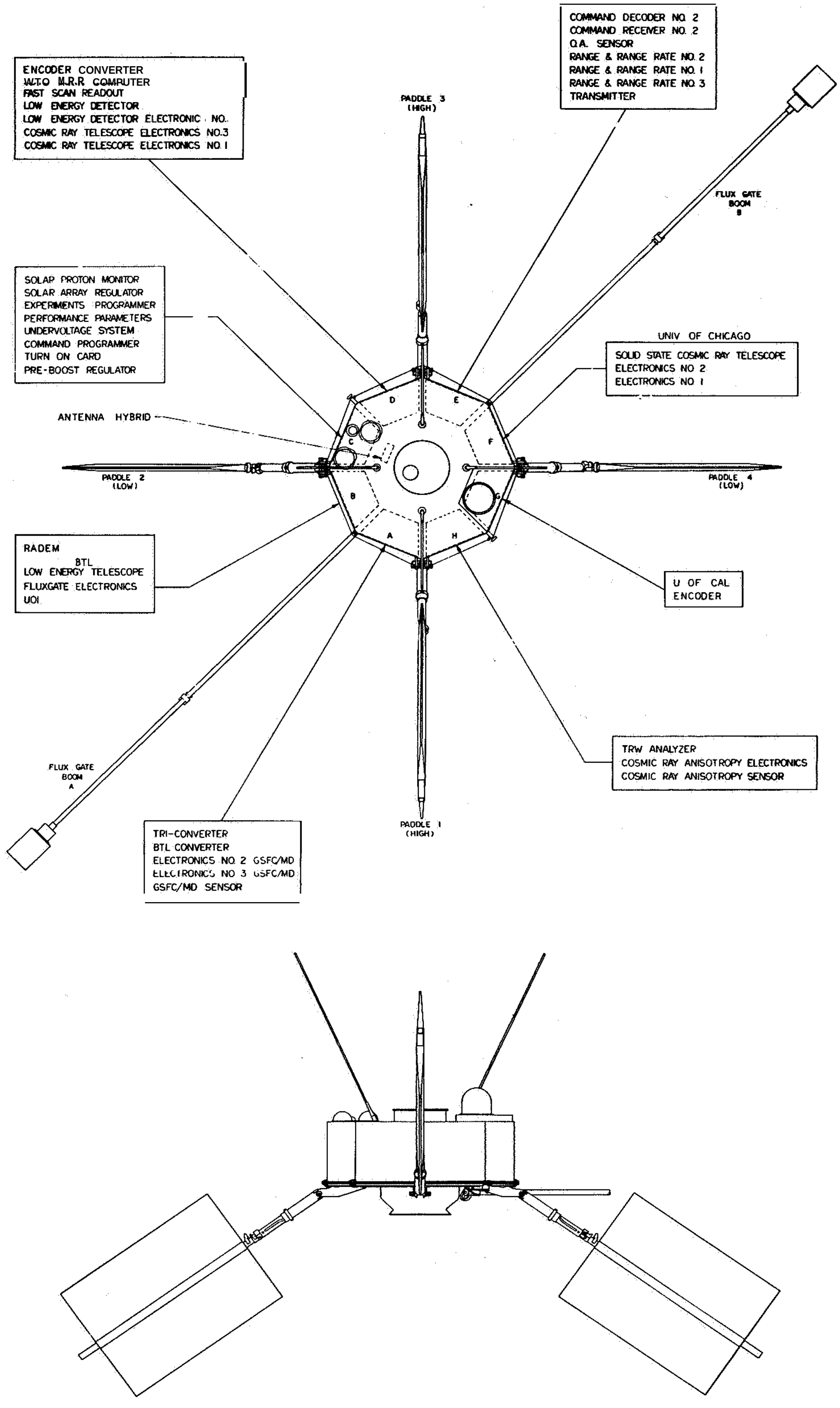


Figure 1–3 – Placement of Experiments and Assemblies

1. Experiment sensor look angles.

2. Stack height and weight.

3. Electrical interface requirements.

7.2 STABILIZATION

The IMP F is spin-stabilized in orbit as well as during third-stage burning.

The spin-rate profile is as follows:

1. Before third-stage ignition, the third stage and spacecraft are spun up to 122 rpm ±10 percent.

2. Following third-stage burnout, the third-stage sequence timers initiate the release of two despin (yo) weights which reduce the spin rate to 90 rpm.

3. Solar paddle and magnetometer boom erection further reduces the spin rate to about 28 rpm.

Since many of the experiments are critically dependent upon the spin rate, the spin rate must remain within 25 to 30 rpm throughout the useful lifetime of the spacecraft.

7.3 OPTICAL ASPECT SYSTEM

The optical aspect system serves three purposes: to determine the orientation of the satellite in space as a function of time, to provide "sectioning" of the satellite spin period for several experiments, and to measure the spin-axis sun-angle and spin rate.

7.3.1 Principles of Operation

The optical aspect system consists of two basic parts: the satellite orientation system and the sectioning system. The orientation system consists of an earth sensor, a digital solar sensor, and the digital circuitry necessary for determining the times at which the two sensors are excited by their respective sources.

The sectioning system consists of an aspect clock which provides the logic decisions necessary to divide the spin period into 64 time sectors. The outputs necessary to meet the experimenters' requirements are generated from this basic division. These requirements are as follows:

1. 65 pulses per spin period with a maximum dead time of ≤ 2 degrees of rotation (dead time is defined as the time between the 64th pulse and the zero pulse in the next series of counts).

2. The zero pulse in the series of 65 pulses must occur with the coincidence of the sun, real or pseudo.

3. 64 pulses per spin period.

4. 16 pulses per spin period.

7.3.2 Accuracy

The accuracy of the digital aspect sensor will be 1 degree in elevation and azimuth and the aspect clock "sectioning" device will have a time division accuracy for each time sector of better than 1 part in 104.

7.3.3 Weight, Size, and Power Requirements

The electronic circuits will be on standard IMP spacecraft cards, 1.75 inches in height. The digital solar sensor, weighing approximately 12 ounces, will be located external to the electronic card. The average power for the satellite orientation system will be 60 milliwatts and for the aspect clock approximately 480 milliwatts.

7.4 PERFORMANCE PARAMETERS

The number of performance parameters has been increased over previous IMPs because of a larger number of experiments, a real-time command system, and increased numbers of temperature measurements for evaluation of the passive thermal control.

Included are 28 analog measurements, 16 on-off flags, and 8 calibration samples (Tables I-1 — I-3).

Of the 28 analog parameters, 12 are sampled each sequence or 175 times per hour; the remaining 16 are time-shared with each group of 8 telemetered during alternate sequences or about 87 times per hour.

Table I-1
IMP F Performance Parameters

PP	Measurement	Telemetry Format Location		
		Seq.	Frame	Channel
1	TRW voltage	all	4	4
2	LEPEDEA level	all	4	5
3	Solar array current	all	4	6
4	Battery voltage	all	4	7
5	Battery charge current	all	4	8
6	Spacecraft current	all	4	9
7	Primary +11. 7 volts	all	4	10
8	Primary +28 volts	all	4	11
9	BTL voltage monitor	all	4	12
10	MOSFET stability test (MOST) voltage	all	4	13
11	RADEM	all	4	14
12	U. of Chicago voltage	all	4	15
13	Battery temperature	even	12	8
14	Pre-boost regulator temp.	even	12	9
15	Solar array temperature	even	12	10
16	Transmitter temperature	even	12	11
17	BTL temperature	even	12	12
18	U. of California temp.	even	12	13
19	U. of Chicago temp.	even	12	14
20	U. of Iowa voltage	even	12	15
21	Bellows temp.	odd	12	8
22	Center tube cover temp.	odd	12	9
23	Lower cone facet H temp.	odd	12	10
24	Spring seat temp.	odd	12	11
25	Top cover facet H temp (skin 1)	odd	12	12
26	Platform facet H temp (skin 2)	odd	12	13
27	+7. 0 voltage	odd	12	14
28	Side cover facet H temp (skin 3)	odd	12	15

Flag	On or Off Indication	Flag	On or Off Indication
1	University of California	9	Magnetometer power
2	Graduate Research Center	10	Optical aspect
3	GSFC/U. of Md.	11	APL
4	TRW	12	Flipper heater
5	University of Iowa	13	Magnetometer range
6	University of Chicago*	14	Mag up
7	E vs dE/dX	15	Mag down
8	BTL**	16	Fluxgate calibration

NOTE: These data are telemetered in channel 2 and channel 3 of frame 4, each sequence.

*Also provides means of verifying paddle erection.
***Also* provides means of verifying separation of the spacecraft from the third stage.

Table 1-3
IMP F Analog to Digital Calibration Data

Sequence	Item
0	Encoder temperature
1	Zero volts reference
2	+4.0 volt (regulated)
3	+2.5 volt (regulated)
4	Encoder temperature
5	Zero volts reference
6	+4.0 volt standard
7	+5.0 volt (regulated)

NOTE: These data are telemetered during channel 1 of frame 4 and repeat every 8 sequences.

The on-off flags indicate the power status of each experiment as well as the optical aspect system. The complete set of flags is telemetered at 20.5 second intervals, 175 times per hour.

The calibration data are included to provide a means of monitoring and updating, if necessary, the calibration of the analog data-handling system.

7.5 PROGRAMMER SYSTEM

The undervoltage detector, contained in the program card, senses the battery voltage and switches the spacecraft load off if the voltage drops below 12.0 volts for 2 seconds or longer. Simultaneously, the freerunning recycle clocks (two for redundancy) are reset to zero. After 4 hours, they automatically reactivate the spacecraft. The spacecraft power is switched by a latching relay which is the only nonredundant component in the system.

Other functions performed by the programmer card include a +12-volt, 120-ohm gate for calibration of the fluxgate magnetometer, a +11-volt gate for BTL calibration, a +12 to +19.6-gate to the magnetometer flipper heater, and a control circuit for the command firing of the TRW door-opening squibs.

7.6 POWER SYSTEM

The IMP F power system uses a four-paddle solar array and silver-cadmium battery for supply and several regulators and converters for providing proper voltages to the spacecraft electronics.

A resettable automatic circuit breaker (ACB) feature has been incorporated into the IMP F design. This unique feature works as follows:

1. All of the experiments (including secondary converters) and optical aspect are switched off* automatically by the command programmer if either of the following conditions occur:

   If the performance parameter card senses a spacecraft power-level in excess of 48 watts (normal average is 35 watts) for a period of 0.5 second.

   If the preboost regulator senses an overload on either of its outputs.

2. The actuation of this feature can be detected on the ground by reviewing performance parameter, flag indicator, and/or experiment data. Ground commands will be initiated to reactivate experiments one at a time.

*Only the primary power system, undervoltage system, encoder, transmitter, range rate, and command system are not automatically switched off.

When the faulty experiment is commanded on, the ACB will trip again, thereby pinpointing the culprit.

7.7 ENCODER AND DIGITAL DATA PROCESSOR

The pulse frequency modulation (PFM) encoding system in IMP F is a natural outgrowth of the PFM system used in IMPs I - III. The encoding system consists of *two* parts, the encoder and the digital data processor (DDP). Both parts are housed in a single package. The encoding system can handle both analog and digital information, with a bit rate of 100 bits per second. All information is encoded into a series of pulsed frequency bursts where each burst contains the intelligence of four binary bits. The burst thus may be any of **16** discrete frequencies, where each frequency is crystal-controlled and coherent to a useful accuracy.

7.7.1 Analog Data Handling

All analog information is digitized to an eight-bit word in the encoder by a single analog-to-digital (A/D) converter. The digitized information is then telemetered in two adjacent bursts, called a channel. This same A/D converter also supplies **256** conversions per sequence to the magnetometer experiment for onboard data processing by the experiment. In-flight calibration data for the A/D converter is telemetered.

The following experiments use the A/D converter directly (Figure 1-4):

1. The magnetometer (three lines called MAG X, MAG Y, and MAG Z) - Each of the three lines is telemetered eight times per sequence for a total of **192** bits per sequence.

2. The TRW Systems experiment (four lines called STL 1, STL 2, STL 3, and STL 4) - Each of the four lines is telemetered four times during sequences zero through seven. Accumulator information is sent in the STL 1 and STL 2 channels for sequences eight through fifteen.

3. Performance parameters - The total number of analog performance parameters is 28 (designated PP 1 through PP 28), 16 of which are subcommutated by two sequences, and 12 telemetered once per sequence for an average of 160 bits per sequence.

7.7.2 Digital Data Handling

Two types of digital data handling are employed, direct scan data and digital data proeessor data.

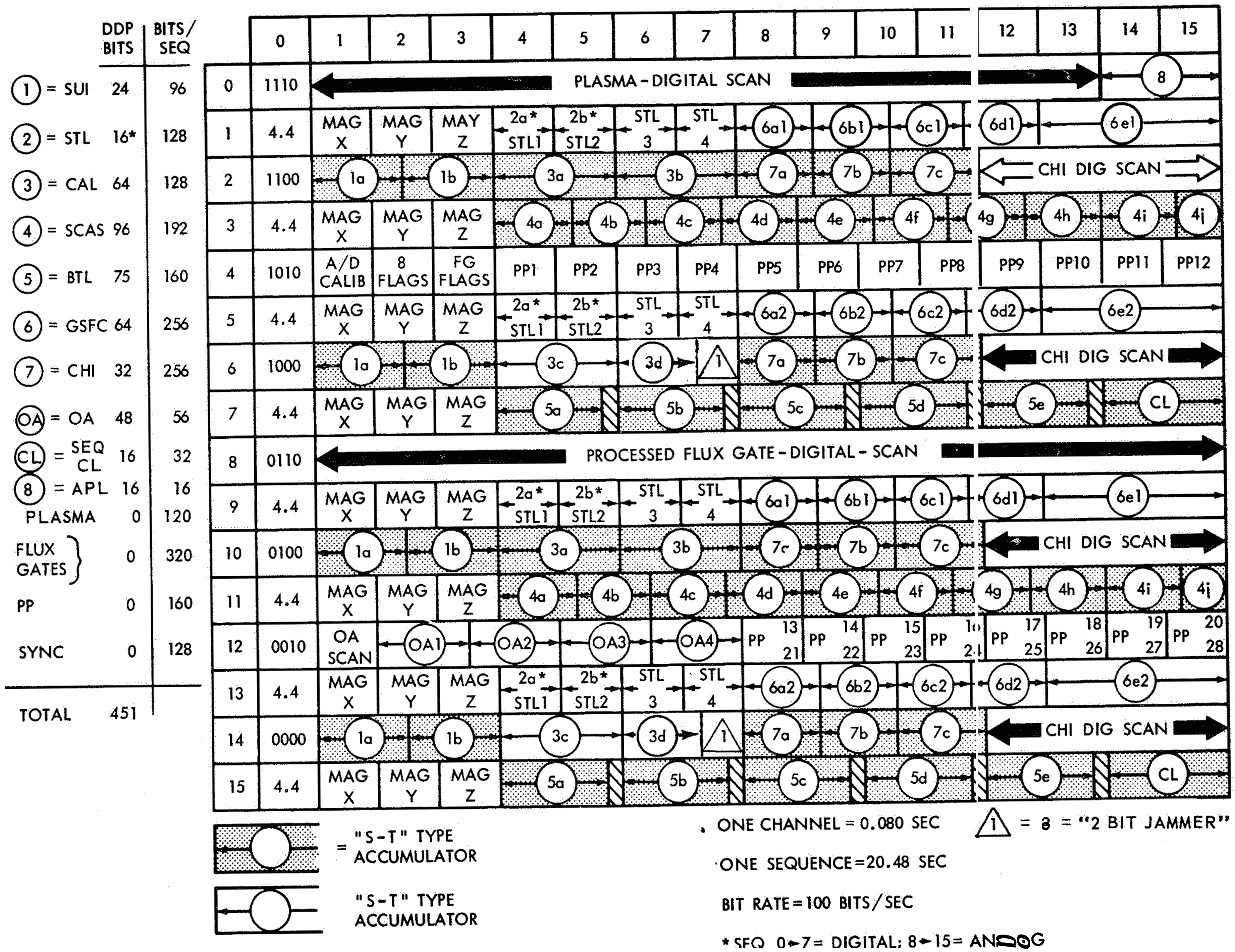


Figure I-4 — IMP F and G Telemetry Format

7.7.2.1 Direct Scan Data—These appear in the format, Figure 1-4, as PLASMA-DIGITAL SCAN (104 bits/sequence), CHI DIG SCAN (128 bits/sequence), and PROCESSED FLUX GATE-DIGITAL-SCAN (120 bits/sequence). For this information, data are scanned four bits at a time.

7.7.2.2 Digital Data Processor (DDP) Data—IMP F has a DDP of expanded capacity and improved design. The experiment capacity of the IMP's DDP is 451 bits, or four times that of IMP I. In addition, most of the accumulators use a bit-compression scheme that allows for a larger dynamic range in counting rate. The digital bit rate is increased by a factor of 10 over that used in IMP I, using the same transmitter power at the same range. This is accomplished by increasing the bits per channel from 3 to 8, and increasing the channel rate by 4. Each burst is obtained from the output of a 16-level, crystal-controlled frequency synthesizer, and the frequencies are "coherent" to auseful accuracy.

Table 1-4 shows the present breakdown for the IMP F DDP.

The "ST" accumulators count pulses up to a maximum and then countclock pulses for the rest of the accumulation period. Thus, either count S or counting rate T will be telemetered. This scheme takes care of the overflow problem and extends the counting-rate dynamic range.

The maximum input rate any accumulator may accept is about 500 kHz. Speed vs power is tailored in the IMP F however, so that most accumulatorsare designed for a maximum input rate of 350 kHz. Maximum experiment rates usually are in the order of 100 to 250 kHz, so that the 350 kHz provide an adequate margin.

8. SCIENTIFIC EXPERIMENTS

The IMP F spacecraft carries 11 distinct scientific experiments. Many of these are advanced designs of experiments previously flown on IMP or other Explorer spacecraft. Table 1-5 lists the experiments, the contributing organization, and the principal investigators.

8.1 LOW-ENERGY TELESCOPE
(Bell Telephone Laboratories, Inc. - Dr. W. O. Brown)

This particle detection experiment will measure the energy spectraof relatively low-energy electrons, protons, deuterons, tritons, and alpha particles outside the earth's magnetosphere and in the region of the magnetospheric boundary. Such measurements, carried out over an extended period during a

Table 1-4
IMP F Digital Data Processor

Item	Accumulator Breakdown*	Storage Bits	Bits/ Sequence
Applied Physics Laboratory, Johns Hopkins University Experiment	1 each, 16-bit "ST"	16	16
Bell Telephone Laboratories, Inc., Experiment	5 each, 15-bit "ST"	75	160
University of California Experiment	2 each, 16-bit "ST" 1 each, 16-bit "S" 1 each, 14-bit "S" 1 each, 2-bit jammer	64	128
University of Chicago Experiment	2 each, 10-bit "ST" 1 each, 12-bit "ST"	32	256
Goddard Space Flight Center Experiments	4 each, 10-bit "S" 1 each, 24-bit "S"	64	256
Southwest Center for Advanced Studies Experiment	9 each, 10-bit "ST" 1 each, 6-bit "S"	96	192
TRW Systems Experiment	2 each, 8-bit "S"	16	128
University of Iowa Experiment	2 each, 12-bit "ST"	24	96
Optical Aspect	4 each, 12-bit "S"	48	56
Sequence Clock	1 each, 16-bit "S"	16	32
TOTAL	38 accumulators	451	

*"ST" stands for Signal or Time

Table 1–5
IMP F Scientific Experiments

Contributing Organization	Experiment	Principal Investigator(s)
Bell Telephone Lab. Inc.	Low Energy Telescope	Dr. W. L. Brown
Univ. of California at Berkeley	Neher-Type Ion Chamber	Dr. K. Anderson
Univ. of Chicago	Range vs Energy Loss	Dr. J. A. Simpson
Univ. of Iowa	Low Energy Proton & Electron Differential Energy Analyzer	Dr. J. A. Van Allen Dr. L.A. Frank
Southwest Center for Advanced Studies	Cosmic Ray Aniso- tropy	Dr. K.G. McCracken
TRW Systems	Sperical Electro- static Analyzer	Dr. F.B. Harrison
GSFC and APL	Solar Proton Moni- toring Equipment	Dr. Carl Bostrom (APL) Dr. D. J. Williams (GSFC)
GSFC and Univ. of Maryland	Plasma Experiment	Dr. K. W. Ogilvie (GSFC) Dr. T.D. Wilkerson (Univ. of Md.)
GSFC	Low Energy Proton & Alpha Detector	Dr. D.E. Hagge
GSFC	Energy vs Energy Loss	Dr. F. B. McDonald
GSFC	Magnetic Field Experiment	Dr. N. F. Ness

time of increasing solar activity, will help provide an understanding of the interactions aniong the particles, plasmas, and fields as they are sensitive to the time varying conditions of the sun. These studies will extend the energy range of higher energy experiments already carried out.

The measuring instrument in this experiment is a multi-element silicon p-n junction telescope, consisting of two thin p-n junction ΔE detectors followed by two thick lithium drift E detectors. The telescope operates behind a shielding entrance cone of 20 degrees half angle (0.38 steradian). This reduces the counting rate due to low energy particles in the front elements of the telescope, restricts the geometrical paths of such particles so they will have well defined lengths in the detectors, and reduces the counting rate due to background particles by keeping the detector array extremely compact. The shielding outside the acceptance cone will exclude protons below at least 30 Mev.

Detectors 1 and 2 are totally depleted devices, 50 and 100 microns thick, respectively. The thinness of the front detector allows positive particle identification for protons as low as 2.4 Mev. The two detectors in series can be penetrated by protons of approximately 4. 5 Mev.

Detectors 3 and 4 are 2 mm thick lithium drifted silicon detectors. These devices are totally depleted except for approximately 75 microns on the lithium-rich side. This side is turned away from the incident particles to minimize their dead layer effects. This is important in detector 3 because of a desire to detect low energy particles as soon as they penetrate detectors 1 and 2. The lithium drift detectors 3 and 4 are encapsulated together in a windowless Kovar can. With this encapsulation, detectors 3 and 4, which are not fabricated in a planar structure as are detectors 1 and 2, are isolated from environmental changes which might adversely affect their junction noise characteristics.

In the experiment, each detector drives an amplifier composed of a low-noise integrating preamplifier followed by a double-clipped linear amplifier. Coincidence conditions among the amplified pulses are established by a zero-crossing system which uses transistor-tunnel diode circuitry. The coincidence requirements are altered by the control logic in various operating modes of the experiment.

Particle identification is established by analog multiplication of signals from the ΔE and E detectors. The multiplication is performed by a field effect transistor system that forms $(E + K_1 \Delta E + K_2)\Delta E$, where K_1 and K_2 are adjustable parameters. The output of the multiplier is examined in a single channel analyzer. The signals being routed to the multiplier as well as the window of the single channel analyzer are changed with the experimental mode by the control logic.

8.2 ION CHAMBER
(University of California at Berkeley - Dr. K. Anderson)

Data from this basic radiation monitor experiment on earlier flights greatly advanced the description of energetic particle populations in and beyond the earth's outer magnetosphere, dynamic processes that influence these populations, and their relation to solar phenomena. The experiment planned for the IMP F satellite will provide further data on this subject. It will also provide information on the presence of medium energy solar electrons near the earth.

The Neher-type of ion chamber provides an immediate and direct way of determining the ionization produced by a spectrum of particles in matter. In connection with the ionization measurement, the GM tubes provide information on electrons below 500 kev which have energy too low to penetrate the ion chamber. For the IMP F space flights, the ion chamber will be mounted on a surface of the spacecraft under a light thermal shield. This has the advantage of providing less absorbing material around the chamber. The background counter will also be modified to provide additional flux data.

One of the counter tubes will detect electrons >45 kev. It discriminates against protons by means of a high atomic number scattering target. The other counter tube will have a large geometry factor and will detect electrons > 20 kev.

8.3 RANGE VS ENERGY LOSS
(University of Chicago - Dr. J. A. Simpson)

This experiment continues the interplanetary and magnetospheric measurements by the University of Chicago on board IMPs I, II, III as part of a long-range study of the spectra of low energy galactic and solar particles in the period where solar activity begins to increase from the solar minimum of 1964-1965 into the new solar cycle. The experiment is designed to identify separately the contributions of nuclei of solar origin from those of galactic origin. The study of galactic spectra for all nuclear species is concerned with the galactic origin of cosmic rays and is intimately connected with the solar cycle modulation of galactic particles as observed near the orbit of earth.

Scientific objectives include measurement of the isotope ratios of hydrogen and helium on the basis of experience with the IMP III telescope. The attained resolution of D_1 and D_2 in IMP III has resolved these isotopes in limited energy ranges. On IMP F the resolution has been increased. To further increase understanding of the modulation of galactic cosmic rays taking place beyond the earth's orbit, this experiment will provide measurements to study the changes with time of the fluxes and spectra of protons, alpha particles, and heavier nuclei.

Charge particles accelerated by solar flares will also be studied. The determination of nuclear species and energy spectra from solar flares, as well as their time dependence, is important for extending knowledge of the acceleration mechanisms and the identification of kinds of flares which are rich in the production of high energy particles. This experiment will also undertake anisotropy studies of the propagation of these particles in interplanetary space.

A solid-state cosmic ray telescope (main telescope) will be employed for the energy loss vs range, or total energy measurements. This telescope can identify and measure protons in the 0.8 - 101 Mev energy range by total absorption. Similarly, total absorption gives identification and measurement of He and higher Z nuclei in the energy ranges between 1 to 3 Mev per nucleon. Some analysis of relativistic particles is also included.

The telescope is made up of three solid-state Li-drifted detectors (D_1, D_2, and D_3), a thick CsI scintillation detector (D_4) viewed by two photodiodes, and two plastic scintillation detectors (D_5 and D_6) viewed by photomultiplier tubes. The scintillator D_6 forms an anticoincidence cylinder which protects the detector system against unwanted particle detection and reduces background effects.

The identification of particles and the measurement of their energy is carried out by measurement of energy-loss and range, or total energy; or, alternatively, by measurement of two energy-losses. There are two dE/dX vs E subsystems within the telescope: D_1 vs D_2 for low-energy particles, and D_2 (or D_1) vs D_4 for high-energy particles. The latter subsystem has a resolution equal to, or better than, the dE/dX vs E system in the University of California IMP III experiment; the D_1 vs D_2 subsystem has still better resolution. To accomplish the measurements, the outputs from detectors D_1, D_2 and D_4 are analyzed by pulse-height analysis. Each pulse-analysis comprises a total of 256 channels and is extended in two energy ranges, each of them characterized by a different channel energy width, and includes information on direction of particle arrival within eight sectors perpendicular to the spacecraft spin axis. Discrete particle range intervals provide counting rate channels of information over several energy ranges.

A second small telescope (electron telescope) will be oriented perpendicular to the main telescope. This telescope is formed by a single well-collimated thick solid-state detector of small area. This telescope has very little sensitivity to protons and heavier particles in two small energy range windows where it can give the flux of low-energy electrons, thus providing information about the shape and intensity of magnetospheric electron spectra in the range 80 kev to 400 kev.

8.4 LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ENERGY ANALYZER (LEPEDEA)

(State University of Iowa - Dr. L. A. Frank and Dr. J. A. Van Allen)

A low-energy particle detector is employed to measure the angular distributions, energy spectra, and spatial distributions of low-energy electrons and protons.

The LEPEDEA instrument, which incorporates the Channeltron device (Bendix nonmagnetic, semiconductor electron multiplier), can measure the differential energy spectra of electrons and protons over the energy range 100 ev to 50,000 ev, with a unidirectional intensity range of 10^4 to 10^{10} $(cm^2 \; sec \; sr)^{-1}$ in any of its energy bandpasses. The Anton 213 GM tube will be included to survey the intensities of electrons $E_e > 40$ kev in the earth's outer magnetosphere.

Objectives of the experiment are:

1. To survey the spatial distributions of electrons and protons of the energy range 100 ev to 50,000 ev inside the earth's magnetosphere, in the transition region adjacent to the magnetospheric boundary and in the interplanetary medium in the vicinity of the earth's magnetosphere.

2. To conduct a temporal study of these spatial distributions within the restraints of the orbital period of IMP F.

3. To make a comprehensive survey of the differential energy spectra of electrons and protons in the energy range 100 ev to 50,000 ev within the earth's magnetosphere and beyond.

4. To survey the angular distributions of low-energy electrons and protons within the magnetosphere and in the transition region.

5. To conduct a continuing survey of the spatial distributions of electrons E_e >40 kev in the midnight side of the earth's magnetosphere at greater radial distances than Explorer XIV (i.e., beyond 16 R_e) and their temporal variations.

6. To make an extensive search for large intensities low-energy protons in the energy range 10 to 100 kev from 2 to 6 earth radii, which arethought to be the predominant contributors to a ring-current around the earth.

The low-energy particle detector consists of two curved-plate electrostatic analyzers, each of which is accompanied by one 270-degree Bendix nonmagnetic, semiconductor electron multiplier (Channeltron). Detector 1 provides the measurement of the differential energy spectrum of electrons, 100 ev to 50 kev. It consists of a curved-plate electrostatic analyzer across which is placed a stepped potential of 0 to 6 kev. The basic detector, a Bendix Channeltron, is placedwith its aperture near the exit slit of the curved-plate electrostatic analyzer. The output pulse of the electron multiplier (gain of 10^4 to 10^5) is fed into a charge-sensitive amplifier, and subsequently into a series of linear amplifiers and a discriminator. The output pulse from the discriminator is then supplied to the logic of the interface electronics. The proton'analyzer, detector 2, is identical to the electron analyzer, except that the voltage on the curved-plate electrostatic analyzer is applied so that the direction of the electrostatic field is reversedwhen compared to that of the electron curved-plate analyzer. This feature allows simultaneous use of the same stepped-voltage power supply for both the proton and electron analyzer, using applied potentials of only one sign. It also condenses the mechanical structure of the experiment, since the curved plates with the applied stepped voltages for both analyzers can be used in common.

8.5 COSMIC RAY ANISOTROPY
(Graduate Research Center of the Southwest - Dr. K. G. McCracken)

This experiment proposes to study the degree of anisotropy of thelow-energy portion of the solar cosmic radiation and to determine the manner in which it varies with time and nuclear species. Special attention was given to the acquisition of data on the anisotropies in cosmic radiation generated in solar flares. To this end, the detector and associated electronics for this experiment were designed to provide a wide dynamic range of counting rate. The goals of this experiment are to measure the anisotropies in the solar cosmic radiation

1. with an angular resolution of 45 degrees.

2. as a function of time.

3. as a function of energy (thus yielding information on the scale size of irregularities in the interplanetary field).

4. for both protons and electrons (thereby providing the possibility of discriminating between energy-dependent and rigidity-dependent scattering and modulating mechanisms).

5. from a point far away from the magnetosphere.

Basically, the cosmic ray anisotropy detector to be employed consists of a 10 gr/cm^2 CsI (Tl) crystal scintillator, an anticoincidence plastic cup, an aperture defining plastic scintillator, a solid-state detector, and a proportional counter. Logic circuits select cosmic rays which pass through the aperture defining scintillator and which come to the end of their range in the CsI (Tl) scintillator. A two-window discriminator selects (1) protons and alpha particles of energy 40-120 Mev and alpha particles of energy 120-200 Mev and (2) electrons of energy 2-12 Mev. The maximum acceptance cone of the detector is 0.36 steradian. Logic circuits also select cosmic rays which pass through the solid-state detector with and without the requirement that they also pass through the aperture defining plastic scintillator. This corresponds to protons of energy 2-40 Mev and alpha particles of energy 8-160 Mev. As the spacecraft spins around an axis perpendicular to the ecliptic plane, the acceptance cone of the detector will sweep around the celestial sphere. The whole 360-degree rotation will be divided into 8 sectors of 45 degrees each, the detector output being connected to the counting circuit appropriate to each octant. The time division of the data into the various octant counters is controlled by an aspect clock, which is synchronized by signals from a solar-aspect sensor. The proportional counter and associated logic circuits measure the angle of arrival with respect to the earth-sun line of protons of energy greater than 2 Mev, and electrons of energy greater than 70 kev. In another logic mode, the output of the proportional counter is subjected to the same octant division procedure employed in the output of the other detectors.

8.6 SPHERICAL ELECTROSTATIC ANALYZER (TRW Systems - Dr. F. B. Harrison)

A spherical electrostatic analyzer has been chosen to study the directional properties, absolute intensity, time variations, and energy spectrum of protons, electrons, and, if they are present, alpha particles in the energy range below 10 kev.

In interplanetary space, the first objective of this experiment will be to get a detailed energy spectrum of the solar wind. By making measurements 15 percent apart in energy, the streaming velocity of the protons and the velocity distribution of the protons relative to the plasma will be determined. The temperature can be deduced from this measurement.

The second objective will be to determine the ratio of protons to alpha particles in the solar wind. If alpha particles are present and are traveling at the same speed as the protons, they will give a peak at twice the plate voltage required for the proton peak. The ratio of the area of the two peaks will give the ratio of the two species. The instrument will also search for particles arriving from directions other than that of the sun.

Another objective will be to study the directional properties of the solar wind. For this measurement, the analyzer voltage is set to the value corresponding to the peak of the solar-wind proton energy spectrum and the flux is measured as a function of angle away from the sun. The results of this measurement will indicate accurately the direction of flow of the plasma, and will test the validity of the theory that the solar wind is a flowing plasma with protons in thermal equilibrium. Next, the analyzer voltage is set to twice the value corresponding to the proton peak, and the angular measurement is repeated. If there is an alpha-particle peak, the angular distribution of the alpha particles will be determined from the results of this measurement.

Inside the outer Van Allen belt, the flux and energy spectra of low-energy protons and electrons will be measured as a function of position.

In the solar-wind energy spectrum mode, the integrating time of the count rate meter is set at 20 msec, corresponding to 2.5 degrees of spacecraft rotation. The analyzer voltage, initially set to accept 10 kev protons, is successively reduced by a factor of $1/5\sqrt{2}$ as each count rate is transmitted to the telemetry unit. A total of 32 proton measurements is made, the last with the analyzer set for 150 ev. The polarity is then switched, and four calibration and background measurements are transmitted to telemetry. Then 16 electron measurements are made, covering the range from 10 kev to 500 ev.

Finally, the instrument switches to the solar-wind direction mode. In this mode, the analyzer is initially set to accept protons at the peak of the energy spectrum, and the solar aspect logic is set to open the gate only for a time corresponding to a specified 5.6 degrees of spacecraft rotation. A set of 64 readings is taken by successively advancing the 5.6-degree window until the entire 360 degrees have been scanned. The anlyzer voltage is now doubled and the 64 measurements are repeated. The angular measurements require a total of 128 readings.

This ends the complete cycle of 180 individual measurements which is repeated indefinitely.

8.7 SOLAR PROTON MONITORING EXPERIMENT

(Applied Physics Laboratory - Dr. Carl Bostrom; GSFC - Dr. D. J. Williams)

The solar proton monitoring experiment (SPME) is a joint venture between GSFC and the Applied Physics Laboratory (APL) of Johns Hopkins University. APL will supervise the fabrication, assembly, test, and calibration of the experiment. GSFC will supervise data processing and computer programming. The co-experimenters will jointly analyze data and transmit the data to the appropriate data center.

The SPME consists of an array of solid-state detectors designed to measure proton intensities in the following energy ranges: $1 \leq E_p \leq 10$ Mev, $E_p \geq 10$ Mev, $E_p \geq 30$ Mev, and $E_p \geq 60$ Mev.

The overall design goal was to obtain a standard, rather simple detection scheme specifically aimed at detecting solar protons. The method chosen was to use separate detectors for each energy range and to employ combinations of discriminator levels and shielding thicknesses to define the energy response of each channel. Such a method allows for accurate absolute flux determinations and for accurate unit to unit comparisons when using a series of payloads to monitor the solar flux over an extended time period (≥ 0.5 solar cycles).

Since the specific goal of observing solar protons requires only that useful data be obtained at high magnetic latitudes or outside the magnetosphere, discrimination techniques to screen out a background flux of high-energy (>100 kev) electrons have not been included. Even when present ($\lambda \lesssim 65$–70 degrees), the electron background will affect only the lower integral energy channels. Further characteristics are as follows:

a. Channel 1 ($E_p \geq 60$ Mev) and Channel 2 ($E_p \geq 30$ Mev): Each of these higher-energy channels consists of three solid-state detectors mounted orthogonally and surrounded by a hemispherical shield. The shielding thicknesses are 5.6 mm Cu and 1.6 mm Cu.

   The detectors are the surface barrier type, fully depleted, 700 microns thick, with a usable surface area of 0.8 cm^2 and a noise level better than 25 kev. A total system (including electronics, etc.) noise level of about 40 kev is expected.

b. Channel 3 ($E_p \geq 10$ Mev): This detector is a 3 mm cubic Li driftedsolid-state device surrounded by 170 mg/cm^2 aluminum shielding.

At low latitudes (below ~ 65 degrees), electron contamination will preclude unambiguous proton data from the channel.

c. Channel 4 ($1 \leq E_p \leq 10$ Mev): This unit is a fully depleted surface barrier detector, 100 microns thick, having a sensitive area of 2.0 cm^2.

8.8 PLASMA EXPERIMENT
(GSFC - Dr. K. W. Oglivie; University of Maryland- Dr. T. D. Wilkerson)

This experiment will be carried on IMP F to determine the composition and energy distribution of ions in the interplanetary plasma. Its scientific objectives are:

1. To determine the relative abundance of H^+ and He^{++} ions in the solar wind and transition region.

2. To study flux and energy spectra variations for H^+ and He^{++} ions in the solar wind and magnetosphere.

3. To study ion fluctuations over periods of three seconds and more.

The experiment uses a cylindrical electrostatic analyzer having an acceptance cone of 4 by 20 degrees to select ions of sixteen separate energy per unit charge values between 300 ev and 5 kev. Each of these is further analyzed into H^+ and He^{++} ions by a velocity selector. These ions are individually counted by a secondary emission detector.

As the satellite revolves, the instrument's acceptance cone also revolves. Energy per unit charge steps are changed every revolution when the cone is approximately in the anti-sun direction. The data processing system divides each revolution into sixteen parts and records ΣC_i, the sum of the sixteen sub-total counts C_i, $\Sigma C_i{}^2$, and the number of the segment from which the maximum count comes. This information allows the reconstruction on the ground of the hystogram of counting rate versus azimuthal angle 6 .

8.9 LOW-ENERGY PROTON AND ALPHA DETECTOR (GSFC – Dr. D. E. Hagge)

This experiment uses a low-energy detector to study protons and alphas in the region 0.4 - 8 Mev per nucleon and will provide measurements of both galactic and solar cosmic ray flux levels.

Scientific objectives of this experiment are:

1. To measure the low-energy cosmic ray proton flux in the region 0.4 - 8 Mev.

2. To study the low-energy galactic cosmic ray alpha flux in the region 2 - 8 Mev per nucleon.

3. To study the complete time history of protons and alphas in the above energy range throughout solar cosmic ray events.

4. To study further the possible anomalous emission or storage of low-energy solar particles as observed in the recurrent events detected by Explorer XII.

The primary detector is a large area (3 cm^2), totally depleted solid-state detector using the surface barrier technique to insure a minimum dead layer. Coupled to this is a plastic scintillator anticoincidence counter which serves to define the solid angle (geometric factor 1.8 cm^2 - ster) and greatly reduces the background flux. Light shielding for the detector and scintillator will be provided by a coating of 1000 A aluminum and a 0.75 micron nickel foil.

The experiment will perform a measurement of the total energy of each particle having energy in the range 400 - 8 Mev/nuc. The usual double-valued response of conventional solid-state detectors is avoided by means of the anticoincidence cup. This feature also establishes a well-defined path length in the detector by virtue of the collimation established. The response of the detector to protons and alphas indicates that a proton-alpha overlap is anticipated. The alpha region 8 - 32 Mev (2 - 8 Mev/nuc) contains no proton overlap. The regions of meaningful analysis are, therefore:

Protons	0.4 - 8 Mev/nuc
Alphas	2 - 8 Mev/nuc

The solid-state detector pulses will be fed into one of the two pulse height analyzers on a time-sharing basis. This will provide about 150 kev resolution over the region .4 - 32 Mev. The dual use of these analyzers provides significant savings in weight, power, and spacecraft complexity. Two modes of operation of this part of the experiment will be provided on a time-sharing basis:

1. $A\overline{C}$: This is the method in which all particles which penetrate to the anticoincidence cup are rejected.

2. A only: In this mode the anticoincidence cup is disabled. The second mode is intended primarily for use during periods of very high counting rate following solar flares. Mechanical collimation is provided by the plastic cup.

8.10 ENERGY VS ENERGY LOSS
(GSFC - Dr. F. B. McDonald)

This experiment uses the E vs dE/dX telescope to measure the flux and energy spectra of hydrogen, deuterium, tritium, and helium of the primary and solar cosmic radiation in the interval 12 - 80 Mev/nucleon, as well as tomeasure the flux and energy spectra of electrons in the range 1 - 20 Mev. Scientific objectives expected to be realized from these measurements are:

1. A precise determination of the quiet time galactic H and He spectra in the 12 - 80 Mev/nucleon interval, and the modulation of these two different components as a function of time.

2. A study of the dynamics of solar cosmic ray events as observed with two components of different charge to mass ratio - H and He.

3. A study of the intensity of modulation processes involving electrons of 1 - 20 Mev.

4. A study of the isotopic abundance of deuterium and tritium in theprimary and solar cosmic radiation.

The telescope utilized for this experiment is a combination of scintillators giving both the energy of a charged particle and its rate of energy loss, and is capable of measuring very precise spectra of low intensity components in the presence of a very large background of higher energy particles.

This experiment uses the dE/dX and E technique in order to obtain greater sensitivity in the measurements of the cosmic ray modulation mechanism. Three scintillators are employed; two measure energy loss, and one acts as a guard counter. A signal is received from both energy-loss scintillators when a coincidence occurs, unless the guard scintillator shows that a particle has entered it as well. The top scintillator is made as thin as is consistent with a reasonable light output, so that a charged particle passing through it will be little changed in energy. The light output of this scintillator is then a measure of the particle's rate of energy loss. If the particle is stopped by the lower scintillator, the light output from this scintillator is a measure of the energy of the particle. If the particle completely traverses the E scintillator, an anticoincidence signal from the guard scintillator indicates that the particle has lost only part of its energy in the E scintillator, and the energy measurements are discarded. The particle's energy and its rate of energy loss, together with the theoretical relation between these quantities, identify the particle.

8.11 MAGNETIC FIELD EXPERIMENT (GSFC - Dr. N. F. Ness)

This experiment is designed to measure the vector magnetic field in space with high accuracy and precision. There are three major subjects for investigation:

1. The interplanetary magnetic field.

2. The magnetic field in the magnetosheath.

3. The earth's magnetic tail field.

The IMP F orbital characteristics favor these studies quite uniquely. A significant portion of the spacecraft's lifetime will be spent in the interplanetary medium where measurements will be made of the interplanetary magnetic field undisturbed by the presence of the earth's field. The investigation of the magnetic field in the magnetosheath, a result of the interaction of the supersonic solar plasma with geomagnetic field, will be enhanced because of the complete azimuthal sweep relative to the earth-sun line and the frequent sampling of the magnetosheath boundary layer. In addition, the investigation of the earth's magnetic tail close to the earth forms an important element because of the approximately radial traversal of the earth's tail region for half of the spacecraft year.

A special objective of this experiment is the measurement of the energy spectra of magnetic field fluctuations. This will be accomplished through a computation of the autocorrelation function in a digital processor aboard the spacecraft.

The sensing device employed by this experiment is a dual range three orthogonal component (triaxial) fluxgate magnetometer. The low and high dynamic ranges correspond to A32 and ±128 gammas with respective sensitivities of ±0.32 and ±1.28 gammas at the output of the spacecraft analog-to-digital converter. The range is selected on ground command depending on spacecraft altitude and the earth-sun-probe angle. It is expected that the nominal choice for switching will be at approximately 20 R_e on the night side of the earth and 15 - 20 R_e near the subsolar point and between the dawn and dusk terminator.

Magnetic contamination from the field of the spacecraft makes it mandatory to place the magnetometer sensor at as remote a distance from the satellite as possible. To achieve this, the sensor units are mounted in two canisters at the extremity of two diametrically opposite but identical booms. The two-boom configuration supports a biaxial fluxgate sensor unit on one extremity and a monoaxial sensor unit with flipper device for reorientation on the other. The flipper mechanism provides a 180 degree rotation of the sensor parallel to the spin axis providing calibration of the zero level of the instrument in flight.

Each magnetometer sensor is basically a saturable magnetic core which is driven at a high rate (12 kHz) from positive to negative saturation by a solenoidal drive coil. Any second harmonic signal generated is due to the presence of either an ambient magnetic field component along the axis of the element or the permanent magnetization of the core itself. The voltage output for the system is calibrated to yield the magnetic field component parallel to the axis of the core.

The computation of the autocorrelation function should result in a better assessment of the spatial and temporal characteristics of the magnetic field variations. By implementing this function on board the spacecraft, a very significant reduction in data bandwidth is achieved while preserving information content. The present computer uses 240 sample points to construct 9 flagged products and a summation. These are then log-compressed to 12 bits (4-bit exponent, 8-bit fraction) and read out to the telemetry unit.

9. COMMAND SYSTEM

The IMP F spacecraft employs a command system consisting of **29** ground initiated commands:

Experiment on*	11
Experiment off*	11
Fire TRW door	1
Range and range rate	1
Range and range rate defeat	1
Transmitter on	1
Transmitter off	1
Mag Low Range	1
Mag High Range	1
TOTAL	29

Three experiments, the GSFC/University of Maryland plasma experiment, the State University of Iowa LEPEDEA, and the TRW spherical electrostatic analyzer will be in the off mode during the launch phase and will be commanded on from the ground following injection. In addition, the door covering the TRW sensor will be opened by ground command.

Real-time and near real-time control of the spacecraft will be necessary at certain times during the mission, For example, the spacecraft carries an on-board automatic resettable circuit breaker, which will turn all experiments plus the optical aspect system off in the event of severe power problems (i.e. , short-circuits, extremely high current drains, etc.), Should this occur, it will be necessary to re-activate experiments on a one-by-one basis, isolating the problem and attempting to operate around it.

10. TRACKING AND DATA ACQUISITION

The Space Tracking and Data Acquisition Network (STADAN) operated by GSFC is responsible for all tracking and data acquisition efforts for the IMP F mission.

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*For the command system, two experiments, the GSFC E vs dE/dX and GSFC low-energy detector, are combined into one function; also, the optical aspect system is assigned one of the 11 on-off functions.

10.1 TRACKING

Two types of tracking data will be taken – range and range-rate, and Minitrack.

10.1.1 Range and Range-Rate

The spacecraft carries an onboard range and range-rate transponder which is commanded on by one of the following stations: Carnarvon, Australia; Tananarive, Republic of Malagasy; Rosman, North Carolina; Santiago, Chile; or Fairbanks, Alaska (when operational).

Range and range-rate data acquisition requirements are as follows:

1. At altitudes greater than 30,000 km, 10 minutes of data every 6 hours at 1 per second data rate.

2. At altitudes below 30,000 km, 10 minutes of data every hour at 1 per second data rate.

3. Perigee pass, 10 minutes whenever possible centered about the minimum range at a data rate of 4 per second.

10.1.2 Minitrack Data

Minitrack data will be acquired whenever possible by all stations.

10.2 TELEMETRY DATA ACQUISITION

Telemetered data from the IMP F satellite will be acquired and recorded by the GSFC STADAN.

Complete coverage (100 percent) is required throughout the useful lifetime of the spacecraft or as specified by the project manager. The orbit will be chosen to have a minimum lifetime of 1 to 1-1/2 years; the useful spacecraft lifetime is planned to be about 1 year or more.

11. FLIGHT OPERATIONS

The IMP F flight operations will be categorized in the following four phases:

Phase 1 – Launch Phase (Period: **T-30** min. to less than T+30 min.)

Phase 2 – First Rosman Pass (Period: AOS T+6-1/2 hrs., LOS T+14 hrs.)

Phase 3 — Routine Phase (Period: T greater than 14 hrs. to end of spacecraft useful lifetime, est. 1 year)

Phase 4 — Problem Phase (Period: as required)

PHASE 1 — LAUNCH PHASE

The requirement for a downrange station on ship support at the Air Force Western Test Range (AFWTR) is requested through the Program Requirement Document (PRD). All flight events including spin-up, despin, appendage deployment and separation occur before any STADAN stations can acquire the spacecraft signal.

Shortly after spacecraft separation, the Santiago station will acquire the spacecraft (at approximately T+19 min.) and will provide magnetic-tape recording of spacecraft telemetry until loss of signal (LOS). (Approx, 15 hrs.)

The Santiago station is equipped with IMP F PFM/DHE and will decommutate the spacecraft housekeeping data only, Selected periods of housekeeping data will be punched out on a teletype tape and transmitted in near real-time to the POCC.

PHASE 2 — FIRST ROSMAN PASS

This phase will begin upon initial acquisition of the spacecraft telemetry signal (estimated to be at approximately T+6-1/2 hours) by the STADAN Rosman Data Acquisition Facility (DAF). The purpose of this phase is to evaluate the performance status of the spacecraft and to initiate a series of ground-to-spacecraft commands which will activate several experiments that have been off from launch. Rosman will record spacecraft telemetry as well as relay raw-data via the microwave link to GSFC for real-time data processing. The GSFC Operations Control Center (OPSCON), Project Operations Control Center (POCC), Santiago and its PFM/DHE, and the IMP Data Processing Line are required facilities for this phase. This phase should terminate at approximately T+14 hours. No IMP F ranging commands will be issued while other ground-to-spacecraft commands are in progress.

PHASE 3 — ROUTINE PHASE

Following the successful completion of Phase 2, routine periodic spacecraft monitoring and commanding functions will be performed; these functions are described in the following paragraphs:

MONITORING FUNCTIONS

1. Quick-look Housekeeping Data – Engineering status data consisting of optical aspect, performance parameters, spacecraft clock, experiment status flags, and time, which are processed in real-time or near real-time.

2. Quick-look Experiment Data – Six hours of scientific and engineering data processed quick-look and expedited to the experimenters and project within one or two days after the recording.

Quick-Look Housekeeping Data

The STADAN stations equipped with the IMP F PFM/DHE will relay, in near real-time via TTY, housekeeping data to the POCC. The housekeeping data will include the encoder flags which indicate the on/off status of the experiments. These stations will be capable of monitoring locally and relaying the on/off status of the experiments to GSFC. It is anticipated that all experiments will remain in the "on" status after Phase 2 if no unusual or unexpected circumstances occur. However, since the spacecraft command-programmer system is capable of turning-off the experiments automatically in the event of internal problems and the spacecraft will be commanded twice per orbit to switch the magnetometer to the HIGH or LOW sensitivity range, quick-look monitoring of the spacecraft engineering parameters and experiment on/off status is required. These PFM/DHE stations will send quick-look messages to the POCC, via TTY in near real-time, during their scheduled data acquisition recording passes.

Quick-Look Experiment Data

The Rosman STADAN station will be required to transmit a minimum of 6 hours of recorded spacecraft telemetry data twice per week at a play-back speed of 16-times the recording speed to GSFC, via the microwave link, as soon as possible on a non-interference basis with the other users.

Data Processing will extract both the experiment data and housekeeping data from the quick-look recorded data and distribute the required printouts and magnetic-tapes to the Project Manager and the various experimenters within two days after recording.

Command Functions

The GRARR-equipped stations will be the only stations to command the spacecraft. After completion of Phase 2, the only anticipated spacecraft commands will be for GRARR data and the magnetometer experiment HIGH/LOW sensitivity switching.

PHASE 4 - PROBLEM PHASE

Phase 4 will be initiated if, as a result of performance evaluation during monitoring (Phase 3), it is required to issue activation/deactivation commands to the spacecraft. The following facilities will be utilized during this problem phase on a per-case basis as required.

1. Tananarive and/or Santiago (PFM/DHE) stations for teletype coded housekeeping data only.

2. Rosman and/or Alaska stations and their associated microwave links if real-time data processing of housekeeping S/C data is required.

3. POCC will provide housekeeping data obtained from the near real-time processing of TTY coded data from the PFM/DHE stations and/or real-time processing of spacecraft telemetry data received via the Rosman and/or Alaska microwave links.

4. The IMP F Data Processing Line may be required to process the GSFC tapes recorded from the Rosman and/or Alaska transmission and provide experiment status data (scientific) for project analysis, since the POCC will supply only housekeeping data. Data processing on a special per-case basis will be required to expeditiously process GSFC-recorded tapes on an off-line basis.

5. The Tananarive, Carnarvon, Rosman, Alaska, and Santiago GRARR equipped stations will issue commands to the spacecraft as required.

12. SPACECRAFT TELECOMMUNICATIONS

12.1 COMMAND ASSIGNMENTS

Command Number	Designation	Function	Sequence4
1	MAG - Low Range	Magnetometer low range (532 gamma)	242
2	BTL - OFF	Low-energy Telescope off	245
3	TRW - OFF	Spherical Electrostatic Analyzer off	246
4	GRC - OFF	Cosmic Ray Anisotropy off	254
5	MAG - ON	Magnetometer on	256
6***	U of I - ON	Low-energy Proton and Electron Differential Energy Analyzer on	264
7	XMTR - ON	Transmitter on	265
8	U Cal - OFF	Ion Chamber off	424
9	MAG - OFF	Magnetometer off	425
10****	TRW - ON	Spherical Electrostatic Analyzer on	426
11	U of I - OFF	Low-energy Proton and Electron Differential Energy Analyzer off	452
12***	GUM - ON	Plasma Experiment on	456
13	CRT - ON	Low-energy Proton and Alpha Detector, and Energy-versus-Energy-loss Experiment on	462
14	XMTR - OFF	Transmitter off	465
15	OA - OFF	Optical Aspect off	524
16	BTL - ON	Low-energy Telescope on	525
17	APL - ON	Solar Proton Monitoring on	526
18**	TRW - FIRE	Spherical Electrostatic Analyzer fire	542
19	CHI - ON	Range versus Energy Loss on	546
20	OA - ON	Optical Aspect on	562
21	MAG - High Range	Magnetometer high range (±128 gamma)	564
22	U Cal - ON	Ion Chamber on	624
23	GUM - OFF	Plasma Experiment off	625
24	APL - OFF	Solar Proton Monitoring off	626
25	CRT - OFF	Low-energy Proton and Alpha Detector, and Energy-versus-Energy-loss Experiment off	642
26	GRC - ON	Cosmic Ray Anisotropy on	645
27	GRARR Reset	GRARR Reset	652
28	CHI - OFF	Range versus Energy Loss off	654
29	GRARR-Interrogate	GRARR Tracking	R&RR Command

* All commands must be preceded by an address tone (D).

** This command is planned to be issued during the second Rosman pass.

*** These commands are planned to be issued during the third Rosman pass.

**** This command is planned to be issued approximately T+7 days

12.2 RECEIVER

	GRARR Transponder	Command System
Bandwidth:	80 kHz	80 kHz
Sensitivity:	-115 dbm	-115 dbm
Freq. Stability:	±0.002%	±0.002%
Tuning:	Fixed	Fixed
Type:	Double Superhet	Double Superhet

12.3 TRANSMITTER

	GRARR Transponder	Beacon Tracking System	Telemetry System
Bandwidth:	1.6 MHz	0 (TLM Carr.)	10 kHz
Power (Each Mode):	4 watts*	4 watts*	4 watts*
Method of Modulation:	Phase	None	Phase

*The spacecraft has only one transmitter (4 watts) which is used for the telemetry and GRARR transmissions. The power distribution of this transmitter is as follows:

Normal Operation	GRARR Interrogation
Carrier Power – 1.3 watts	Carrier Power – 2.92 watts
TLM Sideband Power – 2.7 watts	TLM Sideband Pwr – 0.28 watts
	GRARR Sideband Pwr – 0.80 watts

12.4 ANTENNA

	GRARR Transponder	Beacon Tracking System	Telemetry System	Command System
Frequency Range;	136 - 148 MHz	Same	Same	Same
Tuning:	Fixed	Same	Same	Same
Polarization:	Circular & Linear	Same	Same	Same
Gain:	0 db	Same	Same	Same
Beamwidth:	Omnidirectional	Same	Same	Same
Transmission Losses:	0.4 db	Same	Same	Same
Pattern (Basic):	Turnstile	Same	Same	Same
Availability of Measurement Pattern:	Yes	Same	Same	Same
Diplexer :	Stripline	Same	Same	Same

12.5 MODULATION

	GRARR Transponder	Beacon Tracking System	Telemetry System	Command System
Type:	Phase*	TLM carrier	PFM/PM (Index of modulation 1.0 rad. rms)	Sequential Tone

*Uplink: Ranging signal phase-modulated on 148.260 MHz.
Downlink: Ranging signal phase-modulated on 136.140 MHz.

	GRARR Transponder	Beacon Tracking System	Telemetry System	Command System
Format:	Tones plus ambiguity resolving code	None	16x16 (See Telemetry Format, Figure 1-4)	**28** standard tone commands & one GRARR command
Commutation:	On command	None	17 coherent frequencies*	On command

13. TRACKING SUPPORT

13.1 LAUNCH AND EARLY ORBIT PHASE

13.1.1 Western Test Range (WTR)

Tracking data will be required during launch to obtain an effective early-orbit determination. The requirements for this data will be supplied by T&DS to AFWTR through the PRD. Data from both the C-band radar tracking stationsand the WECO Radio Guidance System will be utilized. The orbital insertion vectors of position and velocity, when available from launch tracking of the C-band beacon and the WECO X-band guidance system on the second stage, will provide the means for an initial estimate of the actual versus the predicted nominal orbit achieved.

13.1.2 STADAN Minitrack

The STADAN stations will obtain interferometer tracking data from the 136.140 MHz carrier of the spacecraft telemetry transmitter during passes of the spacecraft through the station's antenna beams.

13.1.3 Goddard Range and Range Rate (GRARR)

Range and Range Rate tracking data **will** be obtained by scheduling the GRARR equipped stations for three minutes of GRARR interrogation every half-hour on a non-interference basis, with ground commands to be given during the initial turn-on of the four spacecraft experiments. Based on the early-orbit

*Consists of 17 squarewave tones, one sync frequency at 1.1 kHz, and 16 data frequencies ranging from 1.6 to 3.1 kHz in 100-Hz steps.

tracking, orbital elements (apogee, perigee, etc.,) within an accuracy of ±3000 kilometers will be available to the POCC four hours after lift-off. Orbital elements will be up-dated at two-hour intervals, depending on tracking data availability.

13.2 NORMAL PHASE

13.2.1 STADAN Minitrack

The STADAN Minitrack stations will provide tracking data during near-earth passes when the signal is of sufficient amplitude. OPSCON/NETCON will schedule these stations throughout the active lifetime of the spacecraft.

13.2.2 Goddard Range and Range Rate

The IMP F GRARR transponder will provide means for GRARR tracking data in addition to that of the interferometer tracking data during near-earth passes and will provide tracking data when the spacecraft exceeds the interferometer range capabilities.

The following stations, as scheduled by OPSCON/NETCON, will be used for obtaining GRARR data throughout the active lifetime of the spacecraft and transponder:

Carnarvon (CARVON), Rosman (ROSMAN), Santiago (SNTAGO), Tananarive (MADGAR), Alaska (ULASKA)

These stations will be scheduled to provide the following coverage:

Sampling Rate:

Above **30,000** kilometers:	**10** minutes every **6** hours at a data sampling rate of one per second.
Below **30,000** kilometers:	**10** minutes every hour at a data sampling rate of one per second.
Perigee pass:	**10** minutes whenever possible, centered about minimum range at a data sampling rate of four per second.

14. TELEMETRY DATA ACQUISITION REQUIREMENTS

14.1 ROUTINE DATA ACQUISITION

The STADAN stations, as scheduled by OPSCON/NETCON, nominally will provide 100 percent telemetry recording coverage, whenever possible, during the active scientific lifetime of the spacecraft. The 100 percent coverage will include 15 minutes of recorded overlap between stations and 5 minutes of overlap between tapes recorded by the same station. The PM detected, 25-burst/second, PFM telemetry data will be recorded on magnetic-tape by an Ampex FR 600 or equivalent at a speed of **3-3/4** ips, together with both Serial Coded Decimal Time (SCDT) and Binary Coded Decimal Time (BCDT), etc., in accordance with GSFC standard track assignments. The STADAN stations will utilize antenna systems having a minimum gain of 21 db whenever possible.

14.2 QUICK-LOOK DATA ACQUISITION

The following stations, in addition to recording telemetry data, will relay to GSFC quick-look housekeeping data and/or quick-look scientific data as specified in the following paragraphs.

14.2.1 Early-Orbit Phase (T+19 minutes to T+14 hours)

First Santiago Pass (T+19 minutes to T+14 hours)—The Santiago station will be used for both magnetic-tape recording and for relaying to POCC, in near real-time, TTY coded spacecraft housekeeping data obtained from the station's IMP F Data Handling Equipment (PFM/DHE).

First Tananarive Pass (T+1 hour to T+6.5 hours)—The Tananarive station will be utilized as back-up for the Santiago station for both recording the spacecraft telemetry signal and for relaying to the POCC, in near real-time, TTY coded spacecraft housekeeping data obtained from the station's IMP F PFM/DHE.

First Rosman Pass (T+6.5 hours to T+14 hours)—The Rosman station will be utilized for recording the spacecraft telemetry signal and transmitting the PFM data in real-time to the POCC and the Data Processing facility via the associated microwave link.

14.2.2 Normal Phase (T+14 hours to end of spacecraft lifetime)

The Tananarive and Santiago stations will be used for both spacecraft telemetry tape recording and for relaying to the POCC TTY coded spacecraft housekeeping data obtained from the IMP F PFM/DHE.

The Santiago and Tananarive stations, whenever possible, will be scheduled to issue the HIGH/LOW sensitivity switching command for the magnetometer experiment. These two stations will confirm locally that the command was successful by utilizing their PFM/DHE. In addition, data (a minimum of 5 minutes) will be relayed in near real-time to the POCC via TTY to establish additional confirmation. The spacecraft magnetometer experiment will be commanded by other GRARR equipped stations throughout the spacecraft lifetime, therefore, the Santiago and Tananarive stations will be scheduled as soon as possible after the command time of the other stations to confirm locally the success of the command and to relay 5 minutes of quick-look housekeeping data to the POCC for additional confirmation.

The following paragraphs describe the present quick-look schedule.

T+14 hours to T+30 days—The Santiago and Tananarive stations will be scheduled for a minimum of four quick-looks, during the beginning and ending of their pass times (within one hour) each day, to be transmitted via TTY in near real-time to the POCC. Three of these quick-looks will consist of transmitting 1 hour (continuous) of housekeeping data. Approximately 4 or 5 quick-looks per day will be required by the stations.

T+30 days to T+90 days—The Tananarive station will be scheduled to transmit 5 minutes of housekeeping data during the beginning of its pass time (within one hour) and the Santiago station will be scheduled to transmit 5 minutes of housekeeping data at the end of its pass time (within one hour). These data will be transmitted via TTY to the POCC in near real-time. Also, either the Santiago or Tananarive station will transmit 1 hour (continuous) of housekeeping data via TTY to the POCC every second day. Approximately 2 to 4 quick-looks per day will be required by the stations.

T+90 days to end of spacecraft lifetime—The Santiago or Tananarive station will transmit 1 hour (continuous) of housekeeping data via TTY to the POCC twice per week. Approximately 4 quick-looks per week will be required by the stations.

14.2.3 Normal Phase (T+1 day to T+l year, estimated) - Scientific Data

The Rosman station will transmit twice a week via the microwave link, as scheduled by OPSCON/NETCON, recorded scientific telemetry data at aplay-back speed of 60 ips (16x real-time) to the Data Processing Recording Facility on a noninterference basis with other real-time microwave users. Each transmission will be approximately 30 minutes in duration since a minimum of **6** hours of re-corded data will be transmitted at 16-times the real-time recording speed.

15. GROUND COMMAND SUPPORT

15.1 EARLY-ORBIT ACTIVATION COMMANDS

During the early-orbit phase, a series of four commands will be issued to activate four experiments that have been off since launch. After successfully commanding-on these four experiments, only the magnetometer-range switching-command and the GRARR ranging-commands will be necessary, unless unusual or unexpected circumstances occur. The Rosman stationwill issue the following four commands, as directed by the Project Manager, at the approximate times indicated:

T+Time (Approx)	Command	T+Time (Approx)	Command
7 hours	GSFC/U. of Md. Plasma	7-1/2 hours	Fire TRW door
7-1/4 hours	Univ. of Iowa LEPEDEA	**7-3/4** hours	TRW experiment

The four commands will be coordinated to prevent conflicts with GRARR interrogation periods.

35.2 MAGNETOMETER EXPERIMENT HIGH/LOW-SENSITIVITY SWITCHINGCOMMAND

The spacecraft magnetometer has two ranges of operation, low (±32 Gamma) and high (±128 Gamma). The GRARR-equipped stations will issue two commands per orbit, command #21 (Magnetometer Low Range) on the outgoing or ascending portion of the orbit and command #1 (Magnetometer High Range) on the incoming or descending portion of the orbit. The spacecraft altitudes at which these com-mands are given vary during the year from 15-times Radius of Earth, Re (ap-proximately 95,550 kilometers), to 20 Re (approximately 127,500 kilometers). It is desired, whenever possible, to command the magnetometer switching when the spacecraft is located in the region between the high-range boundary and 6500 kilometers within the boundary.

16. ENCODER FORMAT

The IMP F encoder format showing the location of the housekeeping data within the format is shown in Table 1-6. The performance parameters (PP's) are identified in Table 1-7 and the encoder flags in Table 1-8.

Table I-6

IMP-F Encoder Format Showing Housekeeping Data Only Channel Number

FRAME	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B	A B
0	FN															
1	Sync															
2	FN															
3	Sync															
4	FN	A/D	FLAGS		PERFORMANCE PARAMETERS											
5	Sync															
6	FN															
7	Sync														CLOCK	
8	FN															
9	Sync															
10	FN															
11	Sync															
12	FN	OPTICAL ASPECT DATA							PERFORMANCE PARAMETERS							
13	Sync															
14	FN															
15	Sync														CLOCK	

One channel occupies	0.08	seconds
One frame occupies	1.28	seconds
One sequence occupies	20.48	seconds

Frequencies Used

1.6 kHz	2.0 kHz	2.4 kHz	2.8 kHz
1.7	2.1	2.5	2.9
1.8	2.2	2.6	3.0
1.9	2.3	2.7	3.1

Reference Frequency - 1.1 kHz (Sync)

Table I-7
Performance Parameter Allocation

FRAME	CHANNEL	PP NO.	EVEN	SEQUENCE PP NO.	ODD
4	4	1	STL Volts	1	STL Volts
4	5	2	U. of Iowa LEPEDEA	2	U. of Iowa LEPEDEA
4	6	3	Paddle Current	3	Paddle Current
4	7	4	Battery Volts	4	Battery Volts
4	8	5	Battery Current	5	Battery Current
4	9	6	S/C Current	6	S/C Current
4	10	7	+11.7 Volts	7	+11.7 Volts
4	11	8	+28 Volts	8	+28 Volts
4	12	9	BTL Bias Volts	9	BTL Bias Volts
4	13	10	MOSFET Volts	10	MOSFET Volts
4	14	11	RADEM Volts	11	RADEM Volts
4	15	12	Chicago Volts	12	Chicago Volts
12	8	13	Battery Temperature	PP-21	Bellows Temperature
12	9	14	Pre-Boost Regulator Temp.	PP-22	Center Tube Cover Temp.
12	10	15	Solar Array Temperature	PP-23	Lower Cone Facet H Temp.
12	11	16	Transmitter Temperature	PP-24	Spring Seat Temperature
12	12	17	BTL Temperature	PP-25	Top Cover Facet H (Skin 1) Temp.
12	13	18	U. of Cal. Temperature	PP-26	Platform Facet H (Skin 2) Temp.
12	14	19	U. of Chicago Temperature	PP-27	+7 Volts
12	15	20	U. of Iowa Volts	PP-28	Side Cover Facet H (Skin 3) Temp.

NOTE: Frame 12 is subcommutated so that PP-13 through PP-20 are in the even sequences and PP-21 through PP-28 are in the odd sequences.

Table I-8
Assignments of Encoder Flags

FRAME 4 CH. NO.	BIT NO.	FLAG NO.	DESIGNATION
2A	1	1	"1" University of California Power ON. "0" University of California Power OFF.
	2	2	"1" GRC Power ON. "0" GRC Power OFF.
	3	3	"1" GUM Power ON. "0" GUM Power OFF.
	4	4	"1" TRW Power ON. "0" TRW Power OFF.
2B	5	5	"1" University of Iowa Power ON. "0" University of Iowa Power OFF
	6	6	"1" Univ. of Chicago Power ON and with paddles erected. "0" Univ. of Chicago Power OFF or paddles not erected.
	7	7	"1" GSFC (CRT-LED) Power ON. "0" GSFC (CRT-LED) Power OFF.
	8	8	"1" BTL Power ON and separation from 3rd stage. "0" BTL Power OFF or no separation from 3rd stage.

Table I-8 (Continued)
Assignments of Encoder Flags

FRAME 4 CH. NO.	BIT NO.	FLAG NO.		DESIGNATION
3A	1	9	"1"	Magnetometer Power ON.
			"0"	Magnetometer Power OFF.
	2	10	"1"	Optical Aspect Power ON.
			"0"	Optical Aspect Power OFF
	3	11	"1"	APL Power ON.
			"0"	APL Power OFF.
	4	12	"1"	Flipper Heater ON.
			"0"	Flipper Heater OFF.
3B	5	13	"1"	Magnetometer operating in low range (+32 gamma).
			"0"	Magnetometer operating in high range (+128 gamma).
	6	14	"1"	(Magnetometer up) Z-axis sensor fully positioned with numbered end in direction of positive thrust axis.
			"0"	(Magnetometer up) Z-axis sensor not fully positioned with numbered end in direction of positive thrust axis.
	7	15	"1"	(Magnetometer down) Z-axis sensor fully positioned with numbered end in direction of negative thrust axis.
			"0"	(Magnetometer down) Z-axis sensor not fully positioned with numbered end in direction of negative thrust axis.
	8	16	"1"	Magnetometer calibration current ON.
			"0"	Magnetometer calibration current OFF.

17. LIST OF ABBREVIATIONS

AOS	Acquisition of Signal
APL	Applied Physics Laboratory
BTL	Bell Telephone Laboratories
CHI	University of Chicago
CRT	Command designation for the Low-Energy Proton and Alpha Detector experiment and the Energy versus Energy-Loss experiment
FG	Flux Gate
GM	Geiger-Mueller Tube
GRARR	Goddard Range and Range Rate
GRC	Graduate Research Center
GSFC	Goddard Space Flight Center
GUM	Command designation for the GSFC/University of Maryland experiment
LEPEDEA	Low-Energy Proton and Electron Differential Energy Analyzer
LOS	Loss of Signal
MAG	Magnetometer
MOSFET	Metal Oxide Silicon Field-Effect Transistor
OA	Optical Aspect
OPSCON	Operations Control Center
PFM/DHE	Pulse Frequency Modulation/Data Handling Equipment

PM	Phase Modulation
POCC	Project Operations Control Center
RADEM	Radiation Effects on MOSFETS
RARR	Range and Range-Rate
STADAN	Space Tracking and Data Acquisition Network
S/C	Spacecraft
SCAS	Southwest Center for Advanced Studies
SEQ CL	Sequence Clock
STL	Designation for the TRW Systems experiment
SUI	State University of Iowa
TLM	Telemetry
TRW	Thompson Ramo-Wooldridge
TTY	Teletype
WECO	Western Electric Company

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DATA PROCESSING PLAN INTERPLANETARY MONITORING PLATFORM-F IMP F

VOLUME II: THE DATA PROCESSING

JULY 1967

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

X-563-67-311

DATA PROCESSING PLAN

INTERPLANETARY MONITORING PLATFORM-F

IMP F

VOLUME II: THE DATA PROCESSING

JULY 1967

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

DATA PROCESSING PLAN
FOR
INTERPLANETARY MONITORING PLATFORM
(IMP F)

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FOR

INTERPLANETARY MONITORING PLATFORM

IMP F

FOREWORD

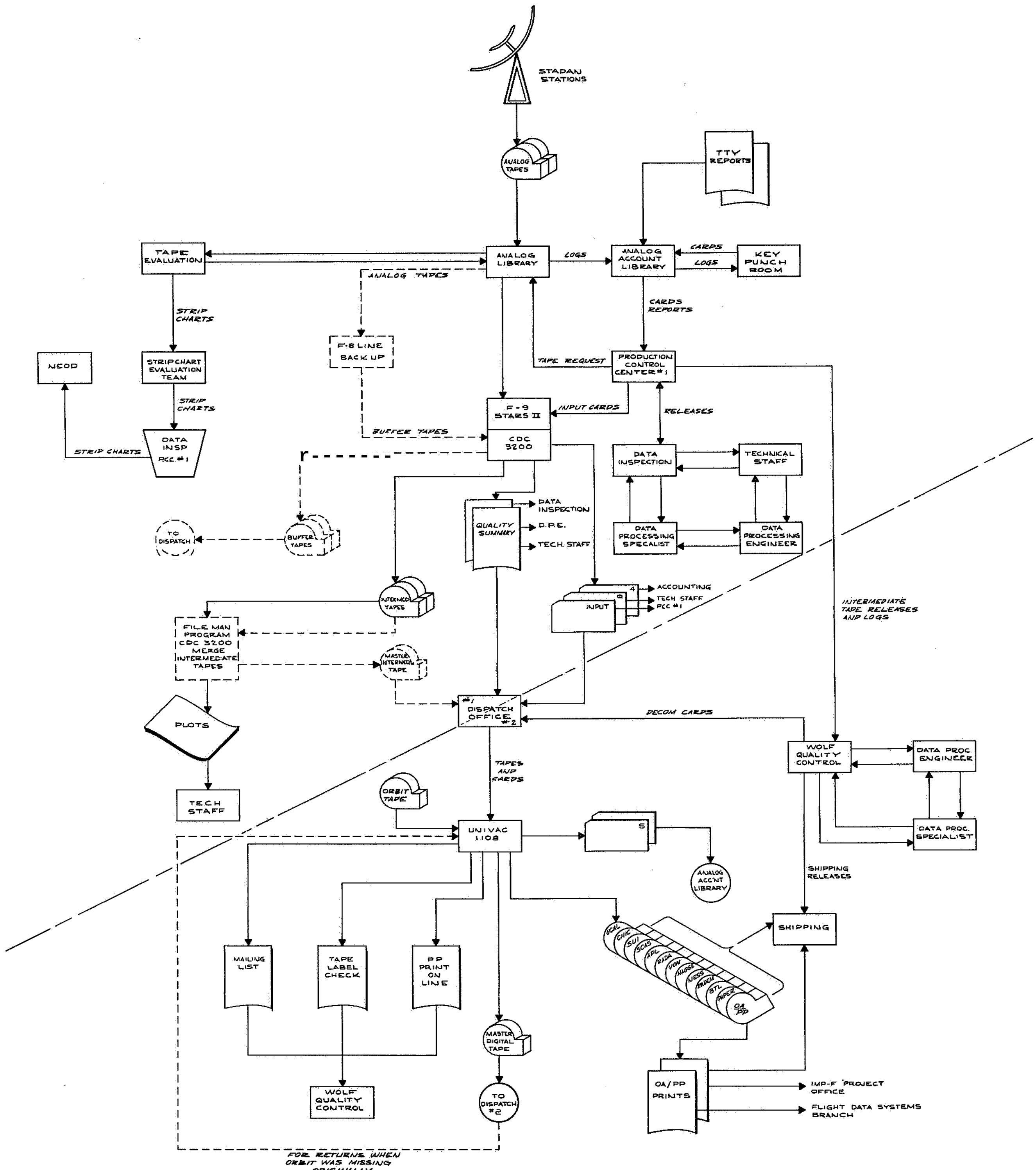
The mission of the IMP F spacecraft is to obtain data on solar and galactic cosmic radiation, solar plasma, energetic particles within the magnetosphere and its boundary layer, and the interplanetary magnetic field.

The satellite, launched from the Western Test Range, has an earth orbit of high eccentricity (nominal apogee 200,000 kilometers and perigee 200 kilometers), perpendicularity of the spin vector to the ecliptic, and an operational lifetime of twelve months.

This volume presents a data processing plan for processing telemetry data received from the IMP F satellite and recorded on magnetic tapes by a network of STADAN tracking stations. These tapes are sent to the Goddard Space Flight Center, Information Processing Division, for data processing.

The analog data on the magnetic tapes is first converted to digital form by the F-9 Processor Line, which performs an analog-to digital conversion and formats the digitized data for input to a CDC 3200 general-purpose computer. The computer performs a quality analysis of the data and generates intermediate data tapes along with a quality summary printout. The intermediate data tapes are then further processed by a Univac 1108 digital computer, which performs time correction and decommutation and then generates separate tapes and/or printouts for each experiment for final analysis by the cognizant experimenter. A master digital tape is also made for the archives; subsequent decommutation reprocessing will use this tape.

All questions regarding changes, corrections, or revisions to this document should be directed to Mr. Harold H. Levy, Assistant Branch Head, Processor Development Branch, Information Processing Division – Building 23, Room W-225. X-4593.



Frontispiece - IMP-F Operations Plan

INTRODUCTION

VOLUME TWO

DATA PROCESSING

1. INTRODUCTION

The Goddard Space Flight Center (GSFC) Information Processing Division (IPD) is responsible for the processing of all telemetry data recorded by the Satellite Tracking and Data Acquisition Network (STADAN) receiving stations. The information processing system designed to treat the IMP F and G satellite data is a new system from the generation of the telemetry in the satellite to the output of data from the processing system on the ground.

The objective of the information processing system is to provide the experimenter with accurate data from his experiment in as short a time as possible.

The major operation performed by the information processing system is the conversion of telemetry signals into a universal digital form which may then be further treated and analyzed by the general-purpose digital computer.

The outputs of the system are digital magnetic-tapes and a paper printout summarizing the information on the tape.

1.1 ANALOG TELEMETRY-TAPE TO DIGITAL COMPUTER-TAPE

The IMP F and G telemetry system (see Tables I-1 and 1-2) uses a coherent digital time-division frequency modulation (PFM) encoding technique which is described in other documents.* The application of this technique has been presented in the interface document.** The telemetry data are designed to be recorded at 1-7/8 ips, but this recording speed would eliminate the third harmonic of some of the data. The third harmonic is needed because of the type of telemetry (phase-coherent) and the cross-correlation detection system which will operate more accurately with a squarewave. The telemetry data thus will be recorded at 3-3/4 ips on tape to be played back on a low-mass reproducer operating at 60 ips, allowing a theoretical reduction of processing time approaching 16/1.

*Report by Roger Cliff in Director's Progress Report, Flight Data Systems Branch, Sept. 1963.
Saliga, T., and Strong.
Saliga, T., and Strong, J. P., 111: Comparison of Phase-Coherent and Non Phase-Coherent Coded Communications. GSFC X-711-65-425, 1965.
**White, Hosea: IMP F and G PFM Encoding System Interface Document, GSFC, Sept. 10, 1964.

Table I-1
Data Rate and Telemetry Format

25 bursts/second
1 frame/1.028 seconds
1 sequence/20.48 seconds
32 bursts/frame
4 bits/burst
100 bits/second
Data to be recorded at **3-3/4** ips, allowing
2 hours maximum data per tape.
Expect approximately 15 tapes per day.
Orbit period: **4** days.

Table 1-2
IMP-F and G Telemetry Sequence Format

Channels →

Frames ↓	0		1		2		• • • • • • •	15	
	a	b	a	b	a	b		a	b
0	14	14							
1	16	16							
2	12	12							
•	16	16							
•	10	10							
•	16	16							
•	8	8							
•	16	16							
•	6	6							
•	16	16							
•	4	4							
•	16	16							
•	2	2							
•	16	16							
•	0	0							
15									

Channel duration: 80 milliseconds
17 unique frequencies
1 sync frequency: 1.1 kHz
16 data frequencies: 1.6 - 3.1 kHz
Channel 0 is sync

3

This new telemetry is an all digital phase–coherent burst–burst PFM signal (the frequency is one of the 16 discrete frequencies). This means that each burst starts with a known phase and all frequencies have four transitions during the burst that have their zero crossovers at the same point. This allows the use of a correlation detection system rather than a comb filter and allows the system to work deeper into noise for a given probability of error.

1.2 FRONT END PROCESSOR LINE

Figure I–1 shows the performance curves for the **F-9** line.* The margins for operation of the line are computed for three different orbits and using a noise temperature of 1830 degrees. There is also a 6 db operational contingency included.

Apogee (km)	Data Processing Margin (db)
226,000 (nominal)	**3.1**
304,000 (high)	0.5
182,000 (low)	5.0

The margins are based on a random distribution of data. If the data assumes a configuration of looking like a constant frequency for a large percentage of the time, a non–coherent sync mode will be used and the sync threshold will drop by **3** to 5 db.

Figure 1–2 illustrates the IMP F On–Line Telemetry Processing System in block diagram form. Figure **1–3** is a block diagram of the F–9 Processor Line and Figure 1–4 is a block diagram of the Front–End Processor.

The fundamental process is for the front–end to find the coherent points in the burst by means of a feedback delay–line formed with a core memory. When the coherent points have been found, the sampled outputs of the correlators are transmitted to the CDC 3200 Computer. The computer then averages the data points at each of the phase–coherent points, and finds the phase which gives the largest magnitude voltage from the correlators. The correct phase to use is then transmitted to the front–end by the computer. The data points are then accumulated into a matrix in the computer and frame and sequence–sync are

+Memo from John Sos to Paul Butler, dated November 16, 1966. Subject IMP F Data Processing Performance Margins.

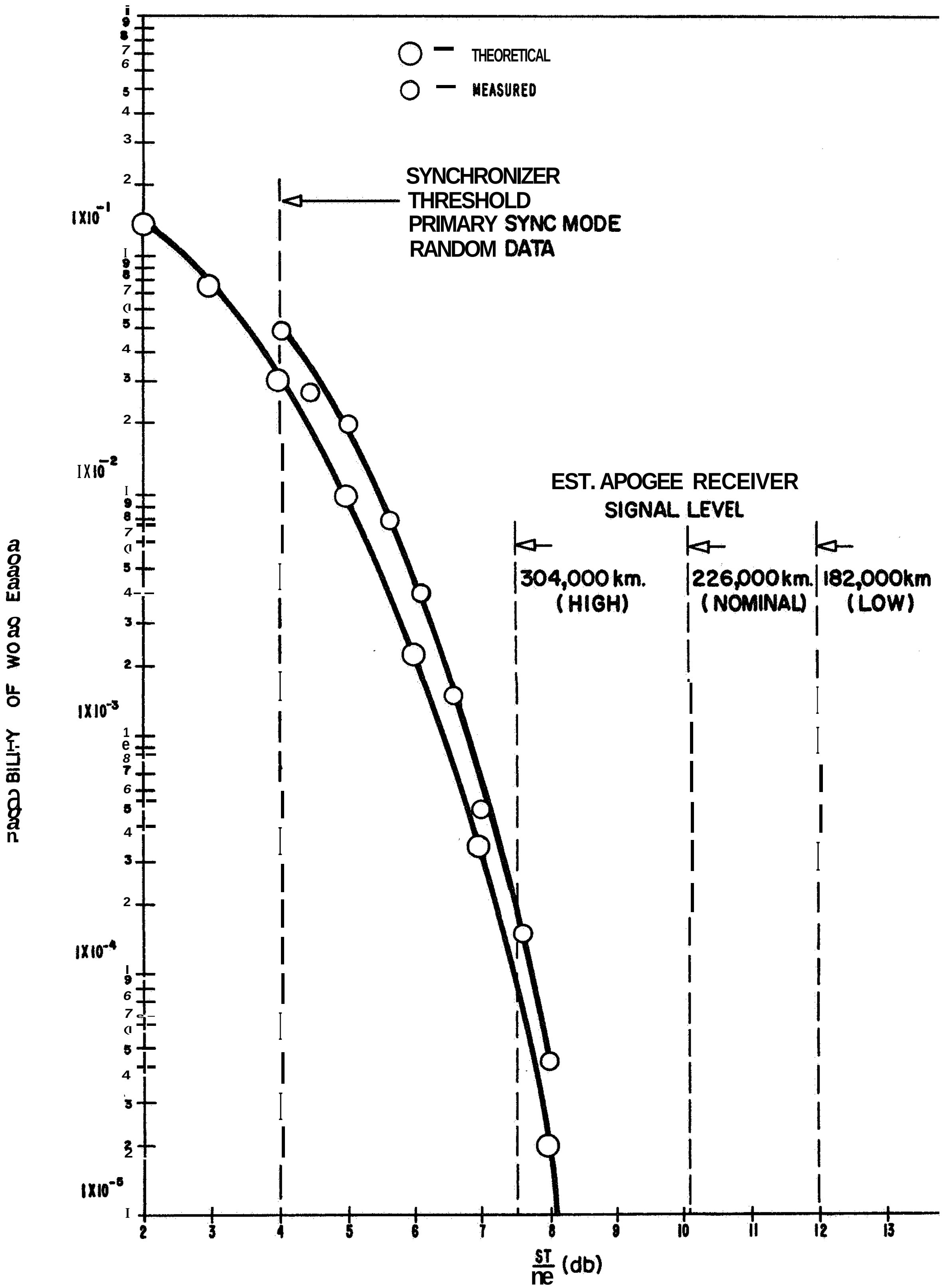


Figure I-1. F-9 Line Performance

4

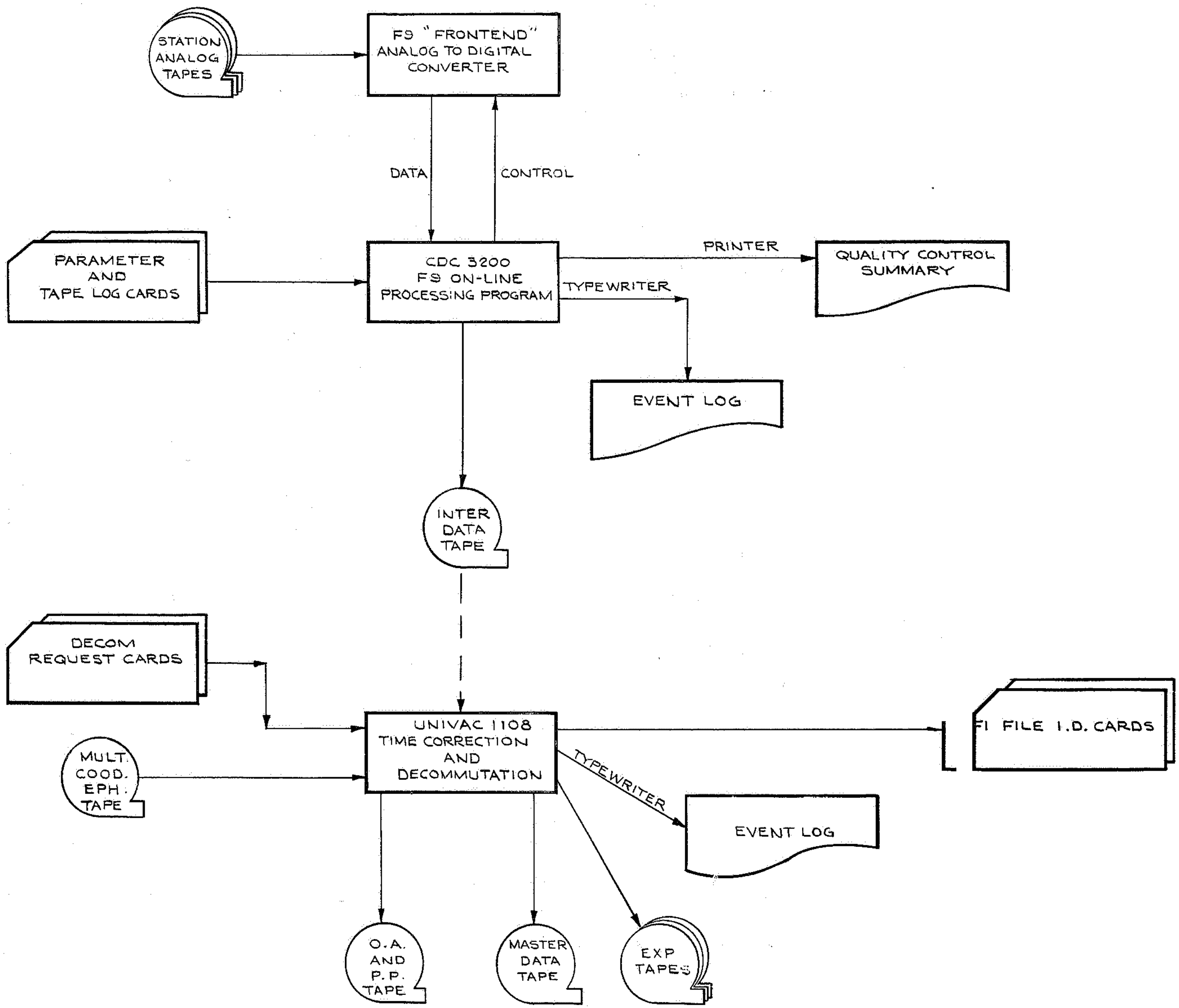


Figure I-2. IMP-F On-Line Telemetry Processing System

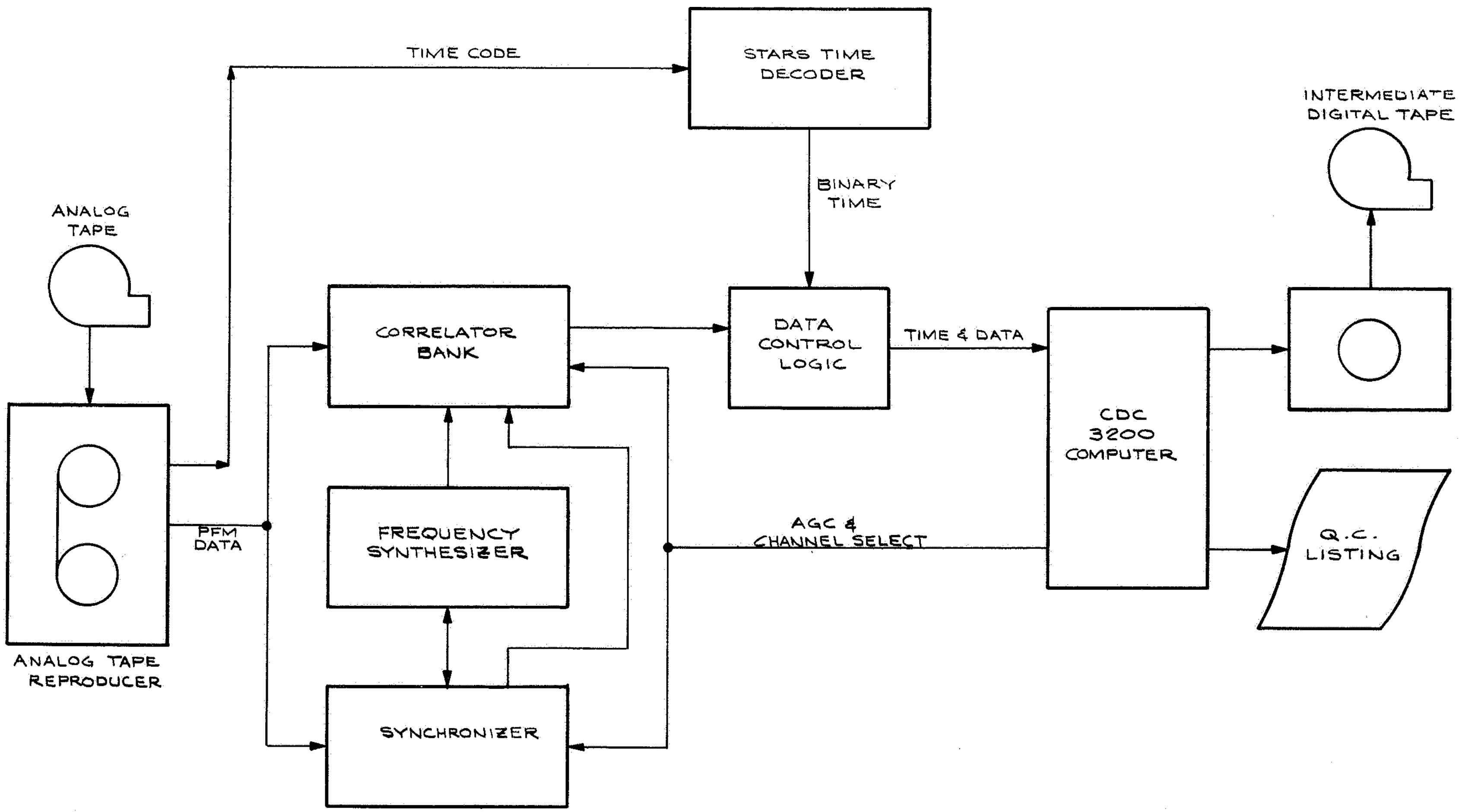


Figure I-3. F-9 Line Block Diagram

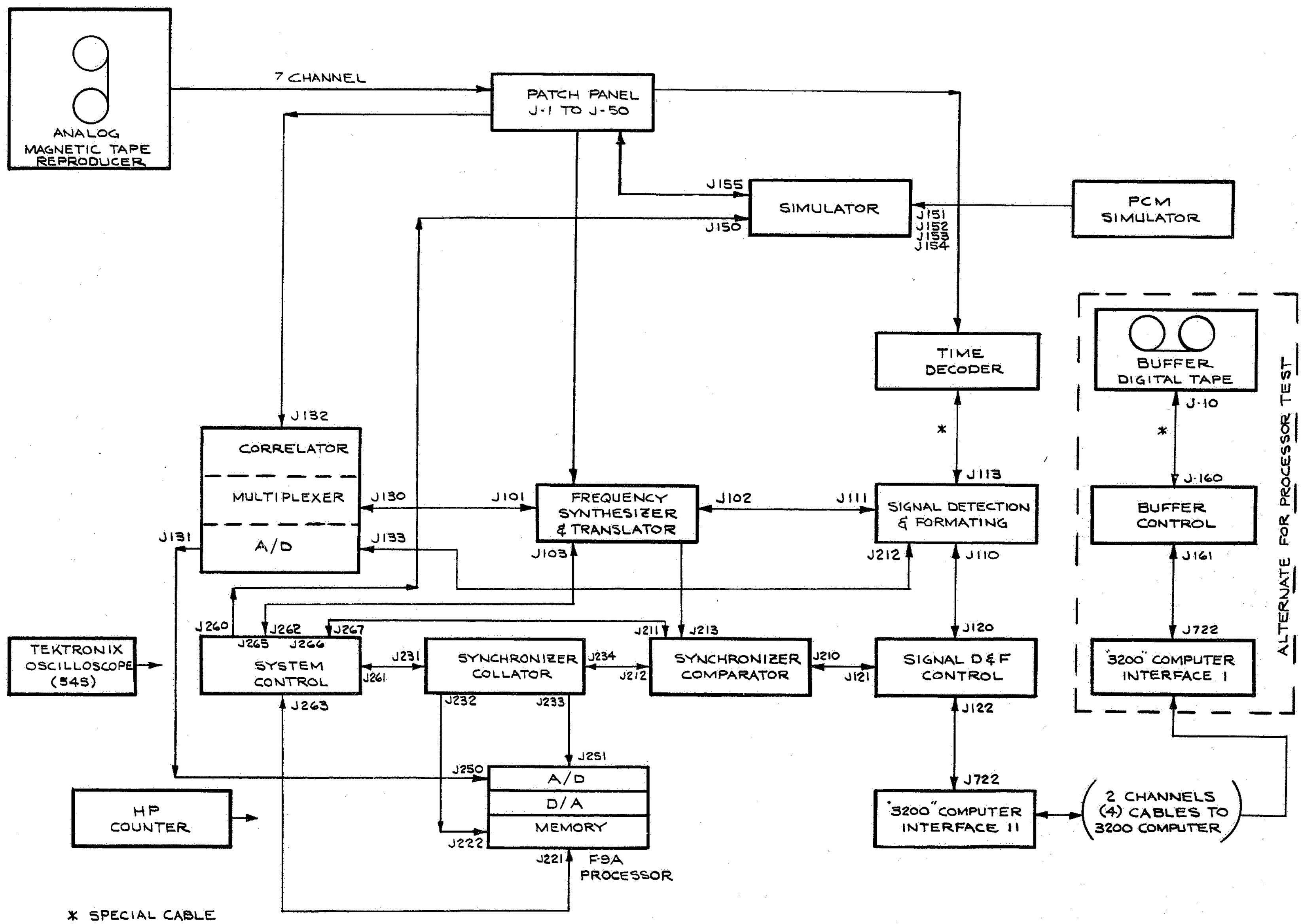


Figure I-4. Front-End Processor Block Diagram identified. Each time phase sync is lost, the computer must re-establish the correct phase point via the channel sync sub-routine. Typeouts from the computer alert the operator for this and similar events. Once channel-sync has been established, decoded station time is sampled once every 32 data-points and sent to the computer by the front-end as the 33rd sample.

The telemetry samples are buffered internally by the computer in order that data-quality checking, formatting, and other processing can continue without having to continuously service the data-input channel.

The computer calculates the mean of the input signal on a sequence basis. This value is used to dynamically control the gain of the input signal depending on the level of the analog signal. The standard deviation of the correlated voltage values is also computed on a sequence basis. The mean and standard deviation are used to compute the signal-to-noise ratio, and to compute the AGC command which is transmitted back to the front-end on the command channel.

The probability of good data is calculated for each four-bit sample using the procedure outlined in paragraph 2.7. One of four quality flags is then assigned according to this calculation. "Good data" is that data having a probability of being the true value falling between 0.99 - 1.00. "Fair data" has a probability of less than 0.99, but equal to or greater than 0.90. "Poor data" has a probability of less than 0.90.

The above quality flags are assigned to full sequences of data only. For partial sequences, such as those obtained after sync acquisition and before sync loss, the mean value of the signal and its standard deviation are not computed. The data samples in these sequences are assigned an "Undetermined" data quality flag.

The quality-flagged synchronized data are written on the intermediate data tape in fixed-length records, in binary form, one sequence per record. The information from one station analog tape will be blocked as one file on the intermediate computer tape. The data from one satellite orbit will be recorded on one or more intermediate tapes.

A summary of data quality information will be printed for each file. An example of this printout is shown in Figure 1-5. This information includes:

1. The number and percentage of data points in each of four data quality categories (Item 1 on the sample printout)

2. The number and percentage of frames recovered (Item 2)

```
                                    QUALITY CONTROL LISTING FOR IMP F9 DIGITAL SYNC MODE
                             (5)
                        YRMODA       HRMNSE                              HRMNSE                    BCD TIME
ANALOG START TIME       670515       145200   DIGITAL START TIME         154741  -(6)          GOOD       BAD  -(7)
                                              DIGITAL STOP TIME          280258                  0          9
ANALOG TAPE N
RBIT NUMBER      0000   STA ION NUMBER    CKP     OPERATOR   LBJ                 10/21/69
OTAL SAMPLES RECOVERED    GOOD      FAIR      POOR      UNDETERMINED
            193             0         0         0           193            -(1)
                          0.00%     0.00%     0.00%      100.00%
    PERCENT
OTAL FRAMES RECOVERED              0
OTAL FRAMES EXPECTED          460411   -(2)
ERCENT FRAME RECOVERY           0.00%
          PERCENT       TOTAL SEQUENCES
          0.00%                0  ONE ERROR IN 100 OR MORE
          0.00%                0  ONE ERROR IN 330                          -(8)
          0.00%                0  ONE ERROR IN 500
          0.00%                0  ONE ERROR IN 1000 OR LESS
ELTA T EXCEEDED TOLERANCE      8  TIMES  -(3)
HASE SYNC LOST                 5  TIMES
SEQUENCE SYNC LOST             0  TIMES  -(4)
PARITY ERRORS
TAPE UNIT=  PROCESSING     A      RECORDING     CPK0000123
PROCESS NUMBER
FRONT-END MALFUNCTION
```

Figure I-5   Example of Data Quality Printout

3. The number of frames where the time difference exceed the tolerance (Item 3)

4. The number of times that channel, frame, or sequence sync was lost (Item 4)

5. Analog start and stop times obtained from analog tape logs, in year (YR), month (MO), day (DA), hours (HR), minutes (MN), seconds (SE). (Item 5)

6. Digital start and stop times, i.e., times of first sync acquisition and last sync loss (Item 6)

7. BCD Time Code quality, referred to the input of the Time Decoder. The Time Decoder usually flywheels through bad samples (Item 7)

8. Estimate of bit error rate, based on computation of the signal-to-noise ratio for each sequence (Item 8). See paragraph 2.7 for more detailed explanation of the method used in this computation.

1.3 INTERMEDIATE COMPUTER TAPE FORMAT

One orbit's data will require 3 intermediate tapes. The information from one analog tape will be written as one file. Each file will have an identification record, followed by data records containing one sequence plus an ID word for a 1284-character record.

No. Characters	These Characters Contain
8	day of year, milliseconds of the day, time flags,
4	successive frame time differences
2	frame number for this record
2	channel number for this time
64	2 characters per channel, 32 channels

This pattern is repeated 16 times, so that one sequence of 16 frames is written as one record.

The format for each of the 8-character time samples is:

<table>
<tr><th>6-Bit Computer Characters</th><th colspan="12">Bits</th></tr>
<tr><td></td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>1 & 2</td><td>1</td><td colspan="8">Time Code Flags</td><td colspan="3">Day</td></tr>
<tr><td>3 & 4</td><td>1</td><td colspan="4">Day of the Yr</td><td colspan="2"></td><td colspan="5">Millisec of Day</td></tr>
<tr><td>5 & 6</td><td>1</td><td colspan="11">Milliseconds of the Day</td></tr>
<tr><td>7 & 8</td><td>1</td><td colspan="11">Milliseconds of the Day</td></tr>
</table>

Each two-character channel sample has the following format:

<table>
<tr><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>O</td><td>F</td><td></td><td></td><td>Q</td><td>Q</td><td colspan="5">W1</td></tr>
</table>

where:

F = Loss of sync flag

if 0, no sync loss has occurred
if 1, sync loss has occurred with this data point

QQ = a two-bit data quality flag

00 = undetermined
01 = probability of good data is 0.90
10 = probability of good data is 0.90–0.99
11 = probability of good data is 0.99–1.00

Figure 1-6 shows a sample printout.

1.4 COMPUTER INPUT FORMAT

The format for all data samples (other than time samples) coming from the Processor into the computer is the following:

```
SEQUENCE,726
OPERATOR

TAPE ID NUMBER=DIGITAL

ELOC - COUNO=0000

0 00232Z00001 6 00W213202o5532Z000000055000001030025604700o10 Z7000001310000ooZ 0000005500oo01030000
0 310000W0140 0o00A2644373440000010300000131000001730000003500 0001030000013130Z00Z66007032630000Z3ZZ
00001067W00Z13Z0Z0553ZZ40000005300000103002560A7000107Z70000013100000ZT000000550000010300000131 0000
001400000 6 Z6A4373AA0000010300000131000001730000005500000103000000 3 5 Z 00Z66007032630000 Z 3ZZ0000 D 67
000Z 3 Z0Z0553ZZ400 00003500000103002560470001oTZ700000 3100000 Z 700000055000001030000 3 D 00000 1 0000
00AZ64437344000001o30000013100000173000000550000010300000131502o0Z6600 o3Z63000023ZZ00001067000Z13Z0
Z 6 53ZZ4000000550000010300256047000107Z 000001310000000Z70000005300 0001o3000001310000001400000 6 Z64A3
73AA0000H103000001 1000001730000000550000 0103000001315020o<06007032630000Z3ZZ0000100 000Z 1 Z0Z0553ZZ4
0000005500000103002560A700010 Z T000001340000002700000055000001030000131000000140000o0 6 Z64A373AA0000
01 8 0000013100000173000000550000010300000 1 5 0Z00Z6600TW3C63000 Z 3ZZ000010000000Z13Z Z 6 53ZZA00000055
000001030025600000107Z 0 00W0 1 1000000Z700000 6 500000103000013 D 00000 5 0000004Z64A373A4000001030000
0 3 1000001730000005500000103000001315020026600703Z63000 Z 3ZZ0000 1 67000Z13Z0Z0553ZZA D 00005500000 6 3
0025604 00o10 Z700000131000000ZT0000005500000103o00o0131000000 1 0000004Z0A43734A00000 D 3000001310000
0173000o00350 00001030000013 15 Z 0026600703263000o 2 ZZ000010670002132Z0Z0553ZZ4000000550000 0 D 300Z560aT
00010TZ70000131000000Z 0 000005500000103000001310000000 3 0000004Z6AA373AA0000010300000013 D 000017300000
0 5 50000001030000013150Z0 Z 6600T03Z63000 Z 3ZZ0000106700 Z 3 Z0Z0553ZZ400000 5 5000001030 Z 56047000 07Z7
000o01310000002 000000550000010300000 3 10000001 4000000 4264 3 7 4A000001030000013100000173000000550000
010300o00131302o026600 7 3 Z630000Z3ZZ000010670 0 213Z0Z055322A000000550000010300256047000107Z7 D 000 D 1
0000oo2 000000550000010300000131000000 1A000000 426443 344000o01030000013100000173000000550000010300000
01313020026600703Z630000Z3Zco00o01067000Z13Z0Z055322 4oo0000 3 3000o010300256047000107Z7000001310000o0Z7
0000005500000103000001310000001A000000AZ6A43 3 AA0000010300000013 D 0000173000000550000010300000013 5 0Z0
0Z6600703z630000Z3ZZ00o01 6 7000Z132 0Z0553ZZA00000 5 5000001 0 00Z56 6 7000107ZT0000013100000 Z 700000 5 5
000001 3 0000013100000001400000 0 AZ6A43734A00000103000000 31000001 3 00 0 005300000 1o300o00131502 00Z660 70
3Z630000232Z00o0106700021 3ZWZ055 3 ZA00000055000001030025604 7000 D 72700000131 00 000Z 00000055 00 00103
000o0 31U0000014000000 4Z6A437 34A000001 0300000 3 1 000017300000055000 0 103000001315 0Z 00266007032630070
3Z6300703Z6300703Z63007NZ630070 3Z63007 Z Z6300703Z63007 3 2 131313131
```

Figure I-6. Sheet 1 - Identification Record

BLOCK COUNT 2 0012

30Z0=723 7 1446760000Z400060100Z225562556Z54 2 5402541Z541Z54ZZ54ZZ54=Z543Z5442544254 5Z545Z540Z540Z547
Z547Z550Z550Z551Z551Z552Z55225 32553Z5542554Z555Z555Z556Z5565020572=-71472760002 *0006020022Z560Z560
Z540Z5412542Z543Z544Z545Z54625 72550Z5512552Z553Z554Z555Z55623572540Z5412542Z=432=44Z545Z=46Z547Z550
2551255225532554255550205723771556760000240006030022255425542541254025432542254525442547254625512550
255325552255525542557255625562557254025412542254325442546255025522554255625572540502057237716427600000
240006040022256025602546255025522554255625572554254525562555254025442556254425402545254225542551 2547
Z551Z54ZZ555Z555Z551Z54 Z 552Z554Z54ZZ54 5 2 057Z377 6067500000Z377 6 5 00ZZZ55ZZ55ZZ55025572541Z550Z54Z
Z55ZZ5572544254oZ554Z55025562552Z543Z557Z551Z5 6 Z544Z5512344Z54125 2 Z540Z550Z3 ZZ555Z540Z50-Z5=1Z546
50Z0572377175273o000Z0000606002Z2Z500Z5602546Z55ZZ544Z544Z554Z547Z556Z540Z543Z555Z546Z54ZZ550Z545Z540
Z54ZZ555Z553Z544Z 5ZZ551Z547Z55ZZ543Z557Z555Z544Z546Z541Z55050Z057Z37717707500000Z4000007002ZZ550Z550
Z555Z553Z546Z55 2 55ZZ533Z542Z53 2 545Z551Z556Z557Z541Z547Z55ZZ54 Z 55 Z 555Z531Z555Z556Z5=3Z540Z554Z547
Z550254525 53Z542Z5=450205723-720627500000Z40006100022Z560Z560Z540Z543Z540Z556Z5432544255625552543255=
Z55Z25452546<544Z5_623502543Z557Z546Z34ZZ54ZZ550Z355Z540Z553Z557Z557Z54 :Z553Z5465020572377214675 0000
240006110022254625462555255125422551254725572540255525502552255425502544255025472540255425462556 2550
25402555255025542547255325502552255625505020572377211275000024000612002225602560254125432556254425 45
2553254425542543254025462543255325542551254525412551255625442550255225432544254525412545255025412557
50205723772256750000240006130022254425442551255225552547254125452555255325412547255725412541 2552 2553
2554255425472550255425452546255525562552255525552551254125455020572377234275000024000614002225602560
2541255525462540254425552545254325512553254225442554254325422544255125502542254625522546254025422543
254725562543254625545020572377236675000024000615002225422542254125512544254525572540254425462551 2555
2543254725572540255025512556254525552541255625542554254525462551254725412557254250205723772452750000
240006160022256025602543254425452553255025452543254725412546254625542550254525412554255325402557 2543
255625532552255225572540255125572544255550205723772476750000240006170022254025402544254225412555 2546
255425472544254525542556255225472557255325512544254325402552255025532556254525512555255225502554 2556
502057237725627500002400062000222560256025502546254125572542254325522553254025472544255225412553 2542
Z5O-Z=4ZZ553Z55=Z545Z55ZZ5542545Z546Z543Z541Z552Z557Z=46Z540Z5Z5Z5Z5

Figure I-6. Sheet 2 – Data Record

SEQUENCE, 667
OPERATOR

+13320	+686	+0	+0	+5267472
+13321	+965	+1279	+1279	+32
•13323	+244	+1279	+0	+32
•13324	+523	+1279	+0	+32
+13325	+802	+1279	+0	+32
+13327	+81	+1279	+0	+32
+13328	+360	+1279	+0	+32
+13329	+639	+1279	+0	+32
+13330	+918	+1279	+0	+32
+13332	+197	+1279	+0	*32
+13333	+476	+1279	+0	*32
+13334	+755	+1279	+0	+32
+13336	+34	+1279	+0	+32
+13337	+313	+1279	+0	+32
+13338	+592	+1279	+0	+32
+13339	+871	+1279	+0	+32
+13341	+151	+1280	+1	+32
+13342	+430	+1279	-1	+32
•13343	+709	+1279	+0	+32
+13344	+988	+1279	+0	+32
+13346	+267	+1279	+0	+32
+13347	+546	+1279	+0	+32
+13348	+825	+1279	+0	+32
+13350	+105	+1280	+1	+32
+13351	+384	+1279	-1	+32
+13352	+663	+1279	+0	+32
+13353	+942	+1279	+0	+32
+13355	+222	+1280	+1	+32
+0	+0	+3421993	+3420713	+32
+0	+606	+606	-3421387	+32

Figure 1-6. Sheet 3 - Time Record

BLOCK COUNT 00056

00000001 001020304050607606 0 1 0 1020304 0 1 0 0205060760040306070000 $ Z2Z0005300000000000000000000000

000000000000000000000000000000000000014130000031600000454000000000000000000000000000000000000000000

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000116060

6060000000020000002000000000000000606045460070326300703263007032630070326300703263007032630070326 3

0070326300703263007032630070326300703263007032630070326300703263007032630070326300703263007032630070

3263007032630070326300703263007 03263007 03263007 032630070326300703263007032630070326300703263

00703263007032630070326300703263007032630070326300703263007032630070326300703263007032630070326300 70

3263007032630070326300703263007032630070326300703263 0 0300703203007032030070320300703263007032630070 3 63

0070326300703263007032630070326300703263007032630070326300703263007032630070326 3 0 07 03263007032630070

32630070326300703263007032630070326300703263007032630070326300703263007032630070326300703263007 03263

0070326300703263007032630070326300703263007032630070326300703263007032630070326300703263007032630070

3263007032630070326300703263007032630070326300703263007032630070326300703263007032630070326300703263

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0070326300703263007032630070326300703263007032630070326300703263007032630070326300703263007032630070

3263007032630070326300703263007032630070326300703263007032630070326300703263007032630070326300703263

0 7032030070326300703263007032630070326300703263007032030070320300703263007032630070326300703263007 0

3263 0703263007032630070326300703263007032630070326300703263515151

Figure I-6. Sheet 4 – Summary Record

	11	10	9	8	7	6	5	4	3	2	1	0
W1	0	1	F					Greatest Correlator Number				
w 2	0	0	Greatest Correlated Value $(X_i)^2$									
w3	0	0						Next Greatest Correlator Number				
W4	0	0	Next Greatest Correlated Value $(Y_i)^2$									

where W1 is the first 12-bit byte of the data sample, W2 is the second byte, etc.

F = sync flag: if = 0, no phase sync loss
if = 1, phase sync loss this sample

The correlator number ranges from 0 to 16; 0 to 15 are data values, **16 is** frame sync. The correlator voltage value is a 10-bit number representing the square of the correlator voltage. The correlator voltage (X_i), therefore, is a 5-bit binary number.

$$w2 = X_i^2$$

$$W4 = Y_i^2$$

1.5 BACK-UP CAPABILITY

In addition to the prime (F-9) information processing system, a computer program has been written which allows the analog station tapes to be processed on the F-8 line. The binary-mode buffer tape from the F-8 line can then be processed by the CDC 3200 program to produce an intermediate computer tape of the same format as from the F-9 on-line system. The F-8 line will not be able to process the data in the coherent mode since it has only a comb-filter and will, therefore, lose 3 db; for good signal-to-noise ratios, the **F-8** line will provide good data.

1.6 EXPERIMENTER AND MASTER DATA TAPES

The intermediate computer tapes from the CDC 3200 on-line processing program are processing on the Univac 1108 computer by the Time Correction and Decommutation programs. The information from the analog-tape log-cards, the recorded station time, and the satellite onboard sequence-clock is used to make any necessary time corrections so that the frame times are as accurate

4

as possible. Once all frame times have been corrected, orbit data is merged with all experimenter data, and the master data tape and the individual experimenter tapes are produced. Each experimenter has selected the orbit parameters that he is interested in, and only those particular parameters will be on his tapes. In the event that orbit data is not available at the scheduled decommutation time, experimenter tapes (appropriately flagged) will be sent with fill data instead of orbit information, and when orbit data is available, new tapes will be made and the experimenters will return the old tapes.

1.7 ATTITUDE DATA

Spin-axis data will be determined by the Flight Data Systems Branch as was done for IMP's A-D.

A copy of the optical-aspect/performance-parameter data printout which goes to the IMP-F Project Office will also be used by the Flight Data Systems Branch to obtain the data they need. The spin-axis angles will go to the Project Office for mailing to the experimenters. The attitude data will be two angles, computed at calendar day intervals, which describe the spacecraft spin-axis orientation in the solar ecliptic coordinate system.

DESCRIPTION

OF

F-9 LINE

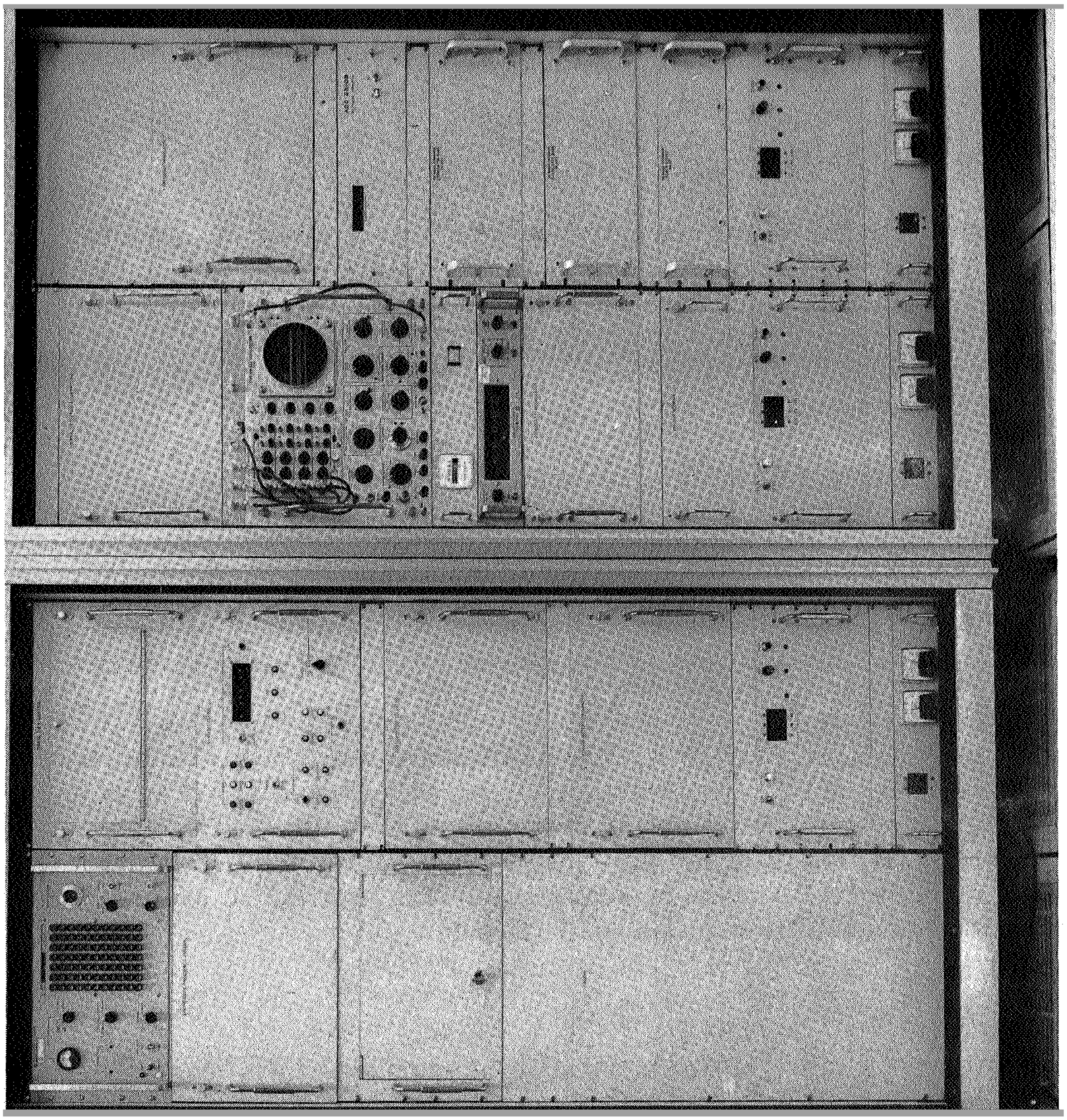


Figure II-1. F-9 Processor Line

2. DESCRIPTION OF F-9 LINE

Production processing of IMP F analog telemetry tapes is performed on the F-9 STARS Data Processing Line. A block diagram of the line is shown in Figure II-2. Major subsystems of the F-9 processor line are as follows:

1. Analog Tape Reproducer
2. STARS Phase I Time Decoder
3. CDC 3200 Computer
4. Front-end equipment consisting of the following major subsustems:
    a. Data Correlator bank and Signal Detection and Formatting unit, including a digital maximum-likelihood detector.
    b. Frequency Translator.
    c. Phase and Channel Synchronizer.
    d. Data Control Logic.

A description of the various subsystems follows:

2.1 ANALOG TAPE REPRODUCER

The analog tape reproducer is a low-mass servo reproducer exhibiting excellent time-base stability characteristics required for proper handling of coherent PFM data. In place of a **60 Hz** servo signal normally used in other reproducers, this particular unit uses the 10-kHz linearizing frequency that is recorded along with the data on the analog tape. The signals that are routed to the system are the BCD time codes and PFM data.

2.2 STARS TIME DECODER

A STARS Phase I Time Decoder is utilized in the system to convert the serial BCD time code to milliseconds of the day and days of the year. The binary time code is multiplexed with PFM data in the Data Control Unit.

2.3 PFM DATA DETECTION

The data-detection system consists of a bank of 17 correlators, one €or each of the frequencies in the coherent PFM frequency set. At the end of each

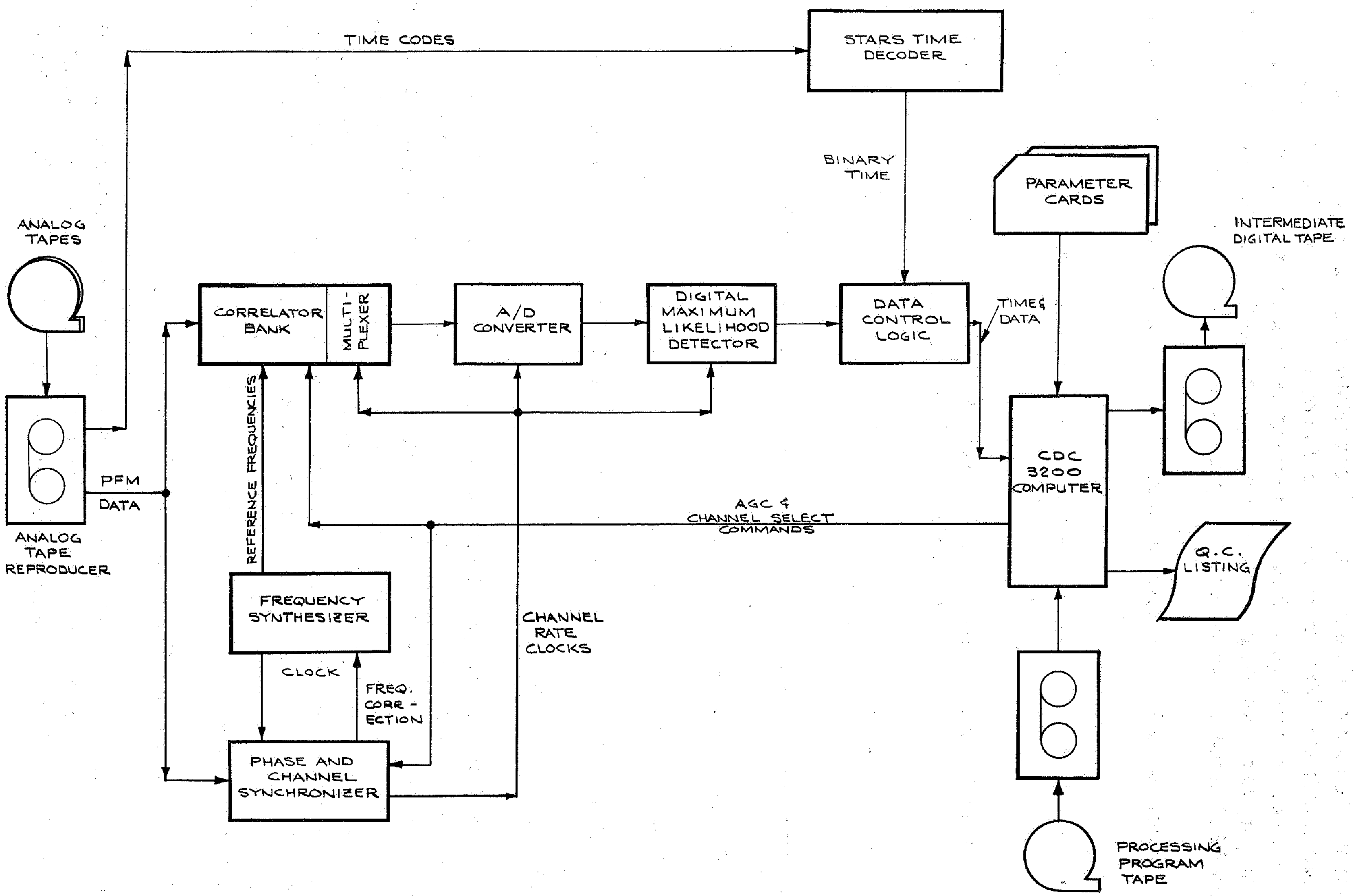


Figure II-2. Block Diagram of F-9 Processor Line

PFM burst, the output of each of the 17 correlators is digitized by an A/D converter and maximum-likelihood detection is performed in the digital logic. The detection process consists of finding the correlator with the largest output, identifying it, and providing this information to the data control unit. The data for each PFM burst is formatted for input to the computer as follows:

Computer Word 1 - number of correlator having the largest output at the end of a data burst.

Computer Word 2 - squared value of the correlator output voltage associated with Word 1.

Computer Word 3 - number of the correlator having the second largest output at the end of the data burst.

Computer Word 4 - squared value of the correlator voltage associated with Word 3.

This information will be used in the computer to do the following:

1. Assign a confidence level to each data point

2. Estimate the input signal amplitude for AGC purposes

3. Estimate the signal-to-noise ratio of the PFM signal being processed

2.4 FREQUENCY TRANSLATOR

The correlation technique of data-detection requires the generation of 17 reference frequencies, representing the 17 frequencies in the PFM signal. In addition, generation of a master-clock frequency for the timing in the various subsystems is required. These functions are performed in the frequency translator subsystem. A digitally-controlled frequency synthesizer is used to generate the master clock for the system. Frequency correction for the synthesizer is provided by either manual-entry or automatically from the phase and channel synchronizer. The master clock is used then as a source for generating the 17 reference frequencies required by the data correlators.

2.5 PHASE AND CHANNEL SYNCHRONIZER

An auto-correlation loop is used for phase and channel synchronization in the system. The synchronization subsystem makes use of a hybrid circulating delay-line filter. This loop exploits a peculiar property of the coherent PFM format; mainly, that each of the bursts, irrespective of which frequency it may be, invariably has zero-crossings at four equally-spaced points within the burst. This form of coherence is extracted throughout the data stream, and is used to obtain synchronization. Because of the large number of repetitions of this phenomenon, extremely accurate synchronization at low signal-to-noise ratios can be obtained. A backup synchronization mode using the unique frame synchronization information is used in cases where the phase-coherent properties of the signal cannot be extracted due to lack of tape-reproducer signal frequency response, or heavy filtering of the signal anywhere in the data transmission path.

2.6 FRAME AND SEQUENCE SYNCHRONIZATION

Frame and sequence synchronization is performed completely by the computer since the F-9 system operates in an on-line fashion with the computer. Whenever loss of frame or sequence synchronization is detected by the computer, the computer returns to the beginning of the frame and/or sequence sync routine and continues searching for frame and sequence sync until re-established.

2.7 ESTIMATION OF PROBABILITY OF CORRECT DETECTION DECISION

As has been previous discussed, the digitized amplitudes of the signals from the correlator with the largest-value output (X) and the correlator with the next-largest-value output (Y), respectively, are retained with each data sample. These amplitudes are made available to the computer, where further data processing takes place. The quantity X is used to compute the mean ($\overline{X}$) and variance (σ^2) of the signal over 512 data samples (a telemetry sequence). From these computations, the difference between the X and Y values is used to compute the data-quality flag for each data sample. The procedure is as follows:

1. Compute mean:

$$\overline{X} = \frac{1}{n} \sum_{1}^{n} X_n \qquad n = \text{one sequence}$$

For example: 512 samples (1 sequence) with 256 samples having an $X_i = 15$ and the rest of the samples, for simplicity's sake, $X_i = 16$ (approximately half-scale, since X_i has a range of 0 - 31, or 5 bits).

$$\overline{X} = \frac{1}{512} \left[(256 \cdot 15) + (256 \cdot 16) \right] = 15.5$$

Note: $\overline{X}$ is given the symbolic name XBAR in the computer program.

2. Compute variance:

$$\sigma^2 = \frac{1}{n} \sum^{n} X_i^2 - \overline{X}^2$$

Following the above example:

$$\sigma^2 = \frac{1}{512} \left[256\ (15)^2 + 256\ (16)^2 \right] - (15.5)^2 = 240.5 - 240.25 = 0.25$$

Note: σ^2 appears symbollically as SIG SQ in the computer program.

3. Compute estimate of S/N ration (L):

$$L = \frac{\overline{X}}{\sqrt{\sigma^2}}$$

In the example:

$$L = \frac{15.5}{\sqrt{0.25}} = 31$$

The quantity $\sqrt{\sigma^2}$ is the standard deviation, or SIGMA, as referred to in the computer programs. Using a look-up table similar to Table II-1, the estimate of the error rate for the sequence can be made. L = 31 represents, of course, a very clean signal; therefore, for this value of L the sequence will be counted as one with an error rate of less than 1 error in 1000 (quantity D in Table II-1). All sequences in the file having an L of 5.01 or higher will be considered to have an average error rate of 1 in 1000 or less. They will be totaled and entered on the Quality Control Listing as shown in Figure 2-5, Item 8.

4. The quality flags for each 4-bit data sample are assigned as follows, once X and σ have been computed for that sequence:

$$Q_i = \frac{X_i - Y_i}{\sigma}$$

Example:

$$Q_5 = \frac{15 - 1}{0.5} = 28$$

The computation for the fifth sample (Q_5) in the sequence will be as shown above. $Y_i = 1$ represents the value of the next-largest correlator output. It is obvious that in this example the confidence that the largest correlator is the true correlator is very high. Referring again to Table II-1, for values of L above 5.01, the value of Q is above the quantity A (0.98 in this case). Sample 5, therefore, will be assigned a "GOOD" data flag in accordance with the following rule:

$Q < A$ = "GOOD" data flag

$Q \leq A > B$ = "FAIR" data flag

$Q < B$ = "POOR" data flag

In another case, when the signal is very noisy a typical case is:

L = 3.5, SIGMA = 1.8

and a typical quality calculation would be:

$$Q_7 = \frac{6 - 5}{1.8} = 0.56$$

This sample would get a "POOR" data flag, since 0.56 is less than quantity B in the table (0.80) for L = 3.5.

In cases where, due to signal loss, a complete sequence of data is not available for computation of $\overline{X}$, σ, and L, an "UNDETERMINED" data flag will be assigned to the data in the partial sequence.

The number of data points in each one of the four quality categories are tabulated by the program on a sequence basis and written on the intermediate tape in the format shown in Figure 1-5. This entry is referred to as SEQUENCE QUALITY FLAGS. (See Table II-1 and page IV-28).

Table II-1
Quality Flag Assignment

Digital Sync Mode

L	A	B	D
0 - 3.00	1.9	0.88	1 error in 100 or more
3.01 - 3.50	1.8	0.80	1 error in 100 or more
3.51 - 4.0	1.45	0.65	1 error in 100 or more
4.01 - 4.50	1.15	0.55	1 error in 330
4.51 - 5.0	1.0	0.45	1 error in 500
above 5.01	0.98	0.42	1 error in 1000 or less

Analog Sync Mode

L	A	B	D
0 - 3.00	2.3	2.2	1 error in 100 or more
3.0 - 3.3	2.2	2.111	1 error in 100 or more
3.3 - 3.9	1.5	0.9	1 error in 100 or more
3.9 - 4.3	1.3	0.65	1 error in 330
4.3 - 4.6	1.1	0.55	1 error in 500
4.6 - 5.10	1.0	0.42	1 error in 1000 or less

CDC **3200**

COMPUTER PROGRAMS

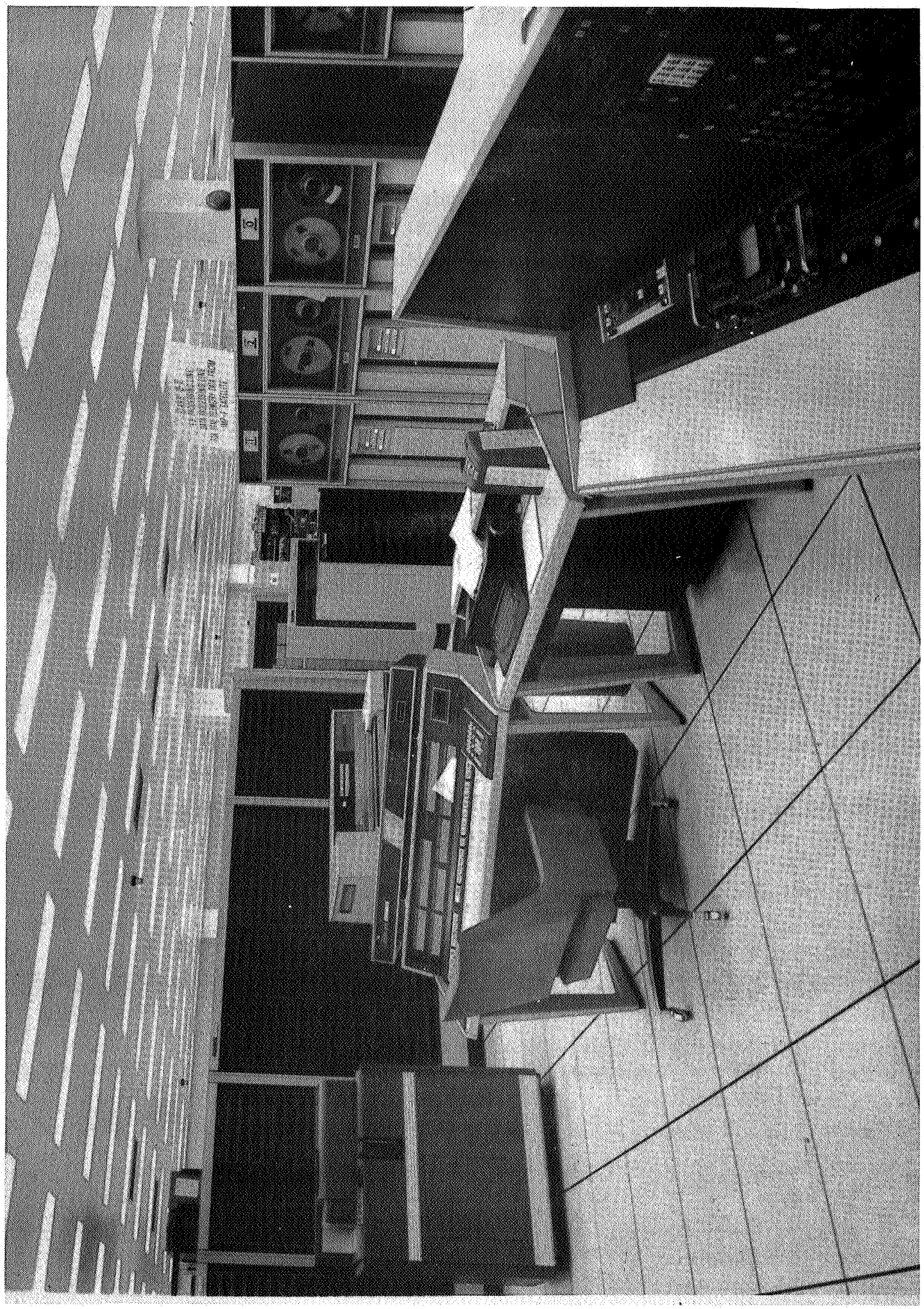


Figure III-1. Photo of CDC 3200 Computer

3. CDC 3200 COMPUTER PROGRAMS

3.1 DIGITAL IMP-F ON-LINE PROCESSOR (DIMPFOLP) PROGRAM

3.1.1 Introduction

Analog station tapes are digitized by the front-end while operating in the digital sync mode and the data is transmitted to the computer. The computer finds and maintains channel, frame, and sequence synchronization. Data quality is computed and a digital, quality-flagged, synchronized, formatted intermediate data tape is written. Figure III-2 shows a sample printout.

3.1.2 Machine Requirements

1. Computer: CDC 3200

2. Storage needed: Approximately 32,570 octal core locations.

3. Required peripherals: Two magnetic-tape drives, card reader, card punch, typewriter, and on-line printer.

4. Operating Mode: On-line and at a speedup of 4-times, 8 times, and 16 times real-time.

5. Input/Output: Input consists of a parameter card from the card reader and data from the F-9 line. Output consists of a formatted intermediate tape, logging information on the typewriter, quality control cards, and file summary quality information from the printer.

3.1.3 Description of Mnemonics

1. DIMPFOLP - Digital IMP-F On-Line Processor:

The beginning of the program sets up interrupts on Channel 4 and Channel 0. Interrupts handled are: Manual from the console, which means an abnormal condition; end-of-data transmission, which is a normal interrupt; and an interrupt at the end-of-data input block, which signals the end of an I/O instruction.

2. NOPRO - Not Processed -

This instruction returns interrupts to CENTRAL INTERRUPT CONTROL (CIC) which are not handled by POCIC.

A. IDENTIFICATION

ONLINE PROCESSOR DIGITAL - COMPASS 32 VERSION MAY 7,1967
P. H. MCCLAIN, CODE 542
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

OIGITAL ONLINE PHOCESSOR ROUTINE FOR THE F-9 PROCESSING LINE DEVELOPED BY THE ADVANCED ORBITAL PROGRAMMING BRANCH, DATA SYSTEMS DIVISION. THIS PROGRAM WILL ACCEPT DATA FROM THE F-9 LINE, ESTABLISH AND MAINTAIN CHANNEL SYNC, VERIFY CHANNEL SYNC, ACQUIRE FRAME ANU SEQUENCE SYNC, COMPUTE DATA QUALITY, ADJUST THE AUTOMATIC GAIN CONTROL, CHECK TIME TOLEHANCE AND PRODUCE A SYNCRONIZED FOAMATED INTERMEDIATE DATA TAPE FROM F-9 DIGITIZED ANALOG STATION TAPE.

C. USAGE

1.SPACE HEQUIREMENIS - 4 BANKS
2.CONFIGURATION HEUUIHEMENTS
1 SYSTEM TAPE, 2 INTERMEDIATE TAPES, CAHD READER, LINE PRINTER, TYPEWRITER, CARD PUNCH.

D. OPERATING INSTRUCTIONS

1. SET UP F-9 LINE FOK OIGITAL AND RESET.
2. LOAD PROGRAM, AT PROGRAM STOP NUMBER 27113 (BASE 8), PUSH GO.
3. OPTIONS
MANUAL INTERRUPT FROM CONSOLE POSITIONS INTERMEDIATE TAPE AT THE LAST END OF FILE MAHK AND RESETS THE PROGRAM.
MANUAL INTERRUPT FROM FHONT-END WRITES SUMMARY RECORD AND END OF FILE MAHK ON INTERMEDIATE TAPE, PRINTS QUALITY CONTROL SUMMAHY ON LINE PRINTER.
SJ2 ALLOWS TWO END OF FILE MARKS TO BE WRITTEN AFTER MANUAL INTERRUPT FHOM FHE FRONT-END AND REWINDS AND UNLOADS INTERMEDIATE TAPE.
SJ5 ALLOWS ADJUSTMENT OF THE AUTOMATIC GAIN CONTROL TO BE LOCKED OUT.
SJ6 WRITES SUMMAHY RECORD AND END OF FILE MARK ON INTERMEDIATE TAPE, PRINTS QUALITY CONTROL SUMMAHY ON LINE PRINTER.
4. PERTINENT REGISTERS
CORE OCTAL LOCATION 26403 CONTAINS NUMBER OF SEQUENCES BEING PROCESSED.
CORE OCTAL LOCATION 26704 CONTAINS AGC VALUE. THIS VALUE MAY BE CHANGED AT CONSOLE.
5.NORMAL PRINTOUT ON TYPEWRITER
(1)ACTION NEEDED IMMEDIATELY.
KESET FRONT-END, THEN PUSH GO.
REAOY CH.4, THEN PUSH GO.
HEAUY CH.0, THtN PUSH GO.
HEADY TAPE NO.1 ON CH.5, UNIT 2 AND PUSH GO.
HEADY TAPE NO.2 ON CH.1, UNIT 2 AND PUSH GO.
TURN OFF SWITCH 6 AND PUSH GO.
READY CAHO READER, PUSH GO.
HEAOY ON-LINE PRINTER, PUSH GO.
CHECK CARD PUNCH AND THEN PUSH GO.
READY CARD PUNCH
HEAOY PROPER FILt ID CARD IN CARD READER, THEN PUSH GO.
WAIT UNTIL PHASE SYNC ACQUIRED, AND THEN PUSH GO.
(2)REPLY NECESSARY FOR PROCESSING
OPERATOR INITIALS(USE 3 LETTERS).

Figure III-2. Digital IMP-F On-Line Processor Program Print

```
        TIME(USE 4 DIGITS).
        DATE(USE 6 DIGITS).
        PROCESS NUMBER (USE SINGLE DIGIT).
        TAPE UNIT PROCESSING (USE A OK B).
        TAPC UNIT RECORDING (USE 10 DIGITS OR LETTERS).
        DIGITAL TAPE NUMBER 1 (USE 5 DIGITS).
        DIGITAL TAPE NUMBER 2 (USE 5 DIGITS).
     (3)INFORMATIVE STATEMENTS
        LOSS OF FRAME SYNC
        OATA FOHMAT ERROR
        LOSS OF PHASE SYNC
        CHANNEL SYNC NOT FOUND
        EXCESSIVE PAHITY ERRORS ON COMMAND CHANNEL
        ALL RECORDS OUTPUTED.
        END OF OATA TRANSMISSION
        FILE SUMMARY WRITTEN
        TIME DIFFERENCE OUTSIDE TOLERANCE
        STATION NOT LISTED IN STATION TABLE.
        INCORRECT PHASE SELECTED.
  ABNORMAL PRINTOUT ON TYPEWRITER
     FIRST HALF OF TIME SAMPLE IS A TIME WORD, SECONO HALF IS NOT
     ERROR TELEMETHY WORD IS NEITHEK A TIME WORD NOR A DATA WORD.
     W4 GT W2, EQUIPMENT MALFUNCTION
     CALCULATEU L LESS THAN ZERO
     THERE ARE NOT 32 DATA SAMPLES BETWEEN TIME SAMPLES
     PARITY ERROR ON INPUT FROM THE FRONT-END,
     PARITY ERROR THIS RECORD.

E. TECHNICAL NOTES
```

Figure III-2 (Continued). Digital IMP-F On-Line Processor Program Print

3. POCIC - Programmer's Own CIC:

This section processes interrupts from Channels 4 and 0 and the manual interrupt from the console.

4. POINT -

This word contains the address (always within the input buffer) of the next data sample to be processed.

5. FETCH -

This subroutine will select the next data sample or time sample from the input block to be processed. This subroutine will keep the F-9 line from overriding the input buffer area and will also keep the processor from getting ahead of the F-9 line.

6. MANIN -

Jump to this instruction to process the manual interruption.

7. DATAIN -

Jump to this instruction to handle the interrupt at the end of normal processing and start terminating operations.

8. CYCLE -

This instruction starts and re-starts the input data flow from the F-9 line into the buffer.

9. REJSIG -

This section notifies the operator of an improper line setup. If operating in the digital sync mode, a "one" in one of the 4 phase sync bits and a "zero" in the 2^5 bit will be sent on Channel 4.

If a REJECT is received on Channel 4, the typewriter will type out IMPROPER SETUP and the program will revert to the beginning.

F and S Bits: F is generated by the front-end (phase) and is the 2^9 bit in W1 of the data sample; F=1 indicates loss of phase sync. S is generated by the computer and is the 2^5 bit of Channel 4; it indicates loss of channel sync or frame and sequence sync.

10. CHSYNC - Channel Sync:

This section connects and selects the command channel, ends the initial phase-indicator command, connects and selects the data channel, and loads samples. Expect four 12-bit bytes every 25 milliseconds, approximately 10 microseconds between bytes.

11. VERIFY -

This subroutine verifies channel sync for 8 frames. If the incorrect phase has been selected, it sends AGC and phase bits on Channel 4 and begins again (See Figure III-3).

12. CFBUFFUL - Check for Buffer Full:

This instruction begins the section which stores fill characters in the remaining buffer and calculates the number of frames expected.

13. INIDER - Identification Routine:

This section of the program reads the parameter card and distributes information to the identification and summary records of the intermediate data tapes. The information from the card is converted from BCD to binary for output on the intermediate tape.

14. BCFTS - Begin Check for Time Samples:

This instruction verifies the time samples and obtains DELTA T.

15. FFS - Find Frame Sync:

This instruction looks for sync values and frame numbers and then establishes frame and sequence sync. The routine also sees that sync is maintained.

16. SSCLOCK - Satellite Clock:

The 16-bit satellite clock register is telemetered back in four bursts, least significant bits of the register first. In order that this register fit the data processing requirements, it is necessary to re-order the burst within the satellite clock in Frame 7 and Frame 15. This is accomplished in the following manner:

Satellite Clock

Frames 7 & 15

LSB			MSB
CH 29	CH **30**	CH 31	CH 32
4 Bits	4 Bits	4 Bits	4 Bits

As received from front–end

CH 32	CH 31	CH 30	CH 29

transformation

N–1	N	N+1
W1	W1	W1
w2	w2	w2
w3	w3	w3
w4	w4	W4

$$\left.\begin{array}{l} W1_N \neq W3_{N-1} \\ W1_N \neq W3_{N+1} \end{array}\right\} \text{No Errors } (E=0)$$

$$\left.\begin{array}{l} W4_N \neq 0, \text{ and} \\ W1_N = W3_{N-1} \text{ or} \\ W1_N = W3_{N+1} \end{array}\right\} \text{Error } (E=1)$$

Make this check for 8 frames; if 50 percent of the valid samples ($W4 \neq 0$) have E=1, then we have picked wrong phase, go back to Channel Sync.

Figure III-3. Verify Proper Channel Sync

17. PERFQC -

The square roots of W2 and W4 are obtained and the sum of W2 and W4 and their square roots are obtained here. M is obtained and stored out.

18. SAV3PLUS -

XBAR, SIGMA and calculated L are computed here.

19. CKINTVL - Check Interval of L:

The range of L is located in a table and the values are used accordingly.

20. CQFS - Compute Quality Flags and Store:

This routine finds the quality flags and stores them in the ouput buffer.

21. FAGC - Find Automatic Gain Control Setting:

AGC is computed and the automatic gain control is increased or decreased, depending on the values of the AGC.

22. SUMCNC -

All Quality Control, information is summed here and readied for output.

23. WTAPE - Write Tape:

This instruction writes-out the information on Channels 1 and 5 of the intermediate tape.

24. EDITPER -

This subroutine will calculate the percentage and edit the answer in AQ.

25. WPRINTER - Write Printer

This instruction outputs information on the on-line printer.

3.1.4 CDC 3200 Typewriter Messages for Both the DIMPFOLP and AIMPFOLP Programs

1. THERE ARE NOT 32 DATA SAMPLES BETWEEN TIME SAMPLES.

2. FIRST DATA SAMPLE AFTER CHANNEL SYNC IS FOUND IS NOT A TIME' WORD.
3. LOSS OF FRAME SYNC.
4. END OF DATA TRANSMISSION.
5. LOSS OF FRAME NUMBER SEQUENCE.
6. Q SUB I OUT OF RANGE (0.45–1.9).
7. PARITY ERROR THIS RECORD.
8. ERROR, TELEMETRY WORD IS NEITHER A TIME WORD NOR A DATA WORD.
9. LOSS OF CHANNEL SYNC.
10. FRAME SYNC NOT FOUND.
11. FIRST HALF OF TIME SAMPLE IS A TIME WORD, SECOND HALF IS NOT.
12. FILE SUMMARY WRITTEN.
13. LOSS OF PHASE SYNC.
14. TIME DIFFERENCE OUTSIDE TOLERANCE.
15. INCORRECT PHASE SELECTED.
16. CALCULATED L LESS THAN ZERO.
17. CALCULATED L IS OUTSIDE LIMITS OF NORMAL L.
18. PARITY ERROR ON THE INPUT FROM THE FRONT–END.
19. W4 GREATER THAN W2, EQUIPMENT MALFUNCTION.
20. IMPROPER SETUP.

4

3.2 ANALOG IMP-F ON-LINE PROCESSOR (AIMPFOLP) PROGRAM

3.2.1 Introduction

This program is nearly identical to the Digital On-Line Processor program (Section 3.1), except that when operating in the analog sync mode, it is necessary for the front-end to find channel sync, Therefore, this computer subroutine is deleted. The digital intermediate data tape and all other outputs are the same as for the DIMPFOLP program. Figure III-4 shows a sample printout.

3.2.2 Machine Requirements

1. Computer: CDC 3200

2. Storage needed: Approximately 32,570 octal core locations.

3. Required peripherals: Two magnetic-tape drives, card reader, card punch, typewriter, and on-line printer.

4. Operating mode: On-line and at a speedup of 4-times real-time.

5. Input/Output: The input consists of a parameter card from the card reader and data from the F-9 line. The output is a formatted intermediate tape, logging information on the typewriter, quality control cards, and file summary quality information from the printer.

3.2.3 Description of Mnemonics

1. AIMPFOLP - Analog IMP-F On-Line Processor:

The beginning of the program sets-up interrrupts on Channel 4 and Channel 1. Interrupts handled are: Manual from the console, which means an abnormal condition; end-of-data transmission, which is a normal interrupt; and an interrupt at the end of the data input block, which signals the end of an I/O instruction.

2. REJSIG -

This section notifies the operator of an improper line setup. Channel sync is bypassed when operating in the analog sync mode. A "one" in the 2^4 bit (channel sync bit) and a "one" in the 2^5 bit (mode of operation bit) will be sent out on Channel 4. If a reject is received on Channel 4, the typewriter will type out IMPROPER SETUP and the program will revert to the START routine.

4 A. IDENTIFICATION

ONLINE PROCESSOR ANALOG - COMPASS 32 MAY 7,1967
P. H. MCCLAIN, COOE 542
GODDARD SPACE FLIGHT CtNTER

a PURPOSE

ANALOG ONLINE PROCESSOR ROUTINE FOR THE F-9 PROCESSING LINE DEVELOPED BY THE ADVANCED ORBITAL PROGHAMMING BRANCH, DATA SYSTEMS DIVISION. THIS PROGHAM WILL ACCEPT DATA FHOM THE F-9 LINE, FIND FHAME AND SEQUENCE SYNC, COMPUTE OATA QUALITY, ADJUST THE AUTOMATIC GAIN CONTROL, CHECK TIME TOLEHANCE AND PRODUCE A SYNCHRONIZED FORMATED INTERMEDIATE TAPE FHOM A F-9 DIGITIZED ANALOG STATION TAPE.

C. USAGE

1. SPACE HEOUIHEMENTS - 4 BANKS
2. CONFIGURATION REQUIREMENTS
   1 SYSTEM TAPE,2 INTERMEDIATE TAPES,CARD READER,LINE PRINTER TYPEWRITER,CARD PUNCH

D. OPEHATING INSTRUCTIONS

1. SET UP F-9 LINE FOR ANALOG AND RESET.
2. LOAD PROGRAM. AT PROGRAM STOP NUMBER 27511 (OCTAL), PUSH GO
3. OPTIONS
   MANUAL INTERRUPT FHOM FRONT-END WRITES SUMMAHY RECORD AND END OF FILE MARK ON INTERMEDIATE TAPE, PRINTS QUALITY CONTROL SUMMARY ON LINE PHINTEH.
   MANUAL INTERRUPT FHOM CONSOLE POSITIONS INTERMEDIATE TAPE AT THE LAST END OF FILt MAHK AND RESETS THE PROGRAM.
   SJ2 ALLOWS TWO END OF FILE MARKS TO HE WRITTEN AFTER MANUAL INTERHUPT FHOM THE FHOEUT-END AND REWINDS AND UNLOADS INTERMEDIATE TAPE.
   SJ5 ALLOWS ADJUSTMENT OF THE AUTOMATIC GAIN CONTROL TO BE LOCKED OUT.
   SJ6 WHITES SUMMARY RECORD ANU END OF FILE MARK ON INTERMEDIATE TAPE, PRINTS QUALITY CONTROL SUMMARY ON LINE PRINTER.
4. PERTINENT REGISTERS
   OCTAL CORE LOCATION 26740 CONTAINS NUMBER OF SEQUENCES BEING PROCESSED.
   OCTAL CORE LOCATIN 27270 CONTAINS AGC VALUE. THIS VALUE MAY BE CHANGED AT CONSOLE.
5. NORMAL PRINTOUT ON TYPEWHITEH
   (1)ACTION NEEDED IMMEDIATELY.
   RESET FRONT-END, THEN PUSH GO.
   READY CH.4, THEN PUSH GO.
   HEAUY CH.0, THEN PUSH GO.
   HEADY TAPE NO.1 ON CH.5, UNIT 2 AND PUSH GO.
   READY TAPE NO.2 UN CH.1, UNIT 2 AND PUSH GO.
   TUHN OFF SWITCH 6 AND PUSH GO.
   READY CARD READER, PUSH GO.
   READY ON-LINE PRINTER, PUSH GO.
   CHECK CARD PUNCH AND THEN PUSH 60.
   READY CARD PUNCH
   HEAUY PROPER FILt IO CAHO IN CARD READER, THEN PUSH GO.
   WAIT UNTIL PHASE SYNC ACQUIRED, ANU THEN PUSH GO.
   (2)REPLY NECESSARY FOR PROCESSING
   UPEHATOH INITIALS(USE 3 LETTERS),
   TIME(USE 4 DIGITS).
   DATE(USE 6 DIGITS).
   PROCESS NUMBER (USE SINGLE DIGIT).

Figure III-4. Analog IMP-F On-Line Processor Program Print

a

TAPE UNIT PROCESSING (USE A OH B).
TAPE UNIT RECORDING (USE 10 DIGITS OH LETTERS).
DIGITAL TAPE NUMBER 1 (USE 5 DIGITS).
DIGITAL TAPE NUMBER 2 (USE 5 DIGITS).
(3) INFORMATIVE STATEMENTS
LOSS OF FRAME SYNC
DATA FORMAT ERROR
LOSS OF PHASE SYNC
CHANNEL SYNC NOT FOUND
EXCESSIVE PAHITY ERRORS ON COMMAND CHANNEL
ALL RECORDS OUTPUTED.
END OF OATA TRANSMISSION
FILE SUMMAHY WRITTEN
TIME DIFFERENCE OUTSIDE TOLEHANCE
STATION NOT LISTED IN STATION TABLE.
INCORRECT PHASE SELECTED.
ABNORMAL PRINTOUT ON TYPEWRITER
FIRST HALF OF TIME. SAMPLE IS A TIME WORD, SECONO HALF IS NOT
ERROR TELEMETRY WORD IS NEITHER A TIME WORD NOR A DATA WORD.
W4 GT W2, EQUIPMENT MALFUNCTION
CALCULATED L LESS THAN ZERO
THERE AHE NOT 32 DATA SAMPLES BETWEEN TIME SAMPLES
PARITY ERROR ON INPUT FHOM THE FRONT-END.
PARITY EHHOH THIS RECORD.

E. TECHNICAL NOTES

Figure TU-4 (Continued). Analog IMP-F On-Line Processor Program Print

F and S bits: F is generated by the front-end (phase sync) and is the 2^9 bit in the W1 word of the data. **F=l** indicates loss of phase sync. S is generated by the computer and is the fifth-bit of the Channel 4 byte; it indicates the loss of channel sync or loss of frame and sequence sync.

3. All other symbolic names are the same for both digital and analog sync programs; descriptions may be found in Section **3.1.3.**

3.3 IMP-F F-9 INTERMEDIATE TAPE PRINT (IFSINTPT) PROGRAM.

3.3.1 Introduction

This program dumps the binary Intermediate Data tape onto the printer in one of three formats: **(1)** decimal conversion, time and channel values - one line per frame; **(2)** octal dump of each entire sequence; and **(3)** decimal conversion, channel values, time, and data-quality flags.

3.3.2 Intermediate Data Tape Printout

This is a decimal print of the intermediate data tape (Figure III-5). Following the file number is a two-line dump of the items on the file I.D. record. Reading from left-to-right (with the number of words per item in parentheses) are: satellite I.D. **(1);** station number **(1);** analog tape number **(1);** recording day year, month, and day **(1);** irrelevant (2); file number **(1)** analog start time hour, minute, and second, **(3);** digital stop time hour, minute, and second **(3);** date tape received year, month, and day, **(3);** tape evaluation code **(1);** date tape was evaluated year, month, and day **(3);** digital line I. D. **(1);** and tape reel number **(1).**

A column header label is printed on each page. Two print lines are required for each frame. The first item in each frame is a **3** character octal number representing the 8 BCD time-code flags; this appears in the TF column. The decimal day of the year is a 3-character item in the DOY column. The millisecond of the day is an 8-digit item in the TIME MILLISEC column.

In the DELTA T column will appear one of three flags, NOT CAL, O K or OUTSIDE, which are: not calculated, within a 10 millisecond tolerance, or outside a 10 millisecond tolerance, respectively. The DELTA T refers to the frame time-differences.

In the FM column is a two-digit number which tags the frames within a sequence with numbers from one to 16. The number in the CL column is used to reduce the frame-time to the beginning of the frame (beginning of Channel 1).

FILE 0001

15 16 3203 7 1 27 7 1 1 6 5 0 8 5 0

INTERMEDIATE TAPE PRINT

TIME

CORRELATOR NO. AND QUALITY FLAGS IN 16 GROUPS PER LINE

ASTERISK FOLLOWING CORRELATOR INDICATES LOSS OF SYNC

TF	DOY	MILLISEC	DELTA T	FM	CL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
377	511	34817727	NOT CAL	01	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	02	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	03	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	04	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	05	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	06	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	07	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	08	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
377	511	34817727	NOT CAL	09	05	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
						31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3	31*3
201	027	21930667	NOT CAL	10	00	16 0	16 0	00 0	01 0	04 0	12 0	00 0	01 0	00 0	00 0	00 0	00 0	10 0	13 0	09 0	13 0
						12 0	00 0	00 0	03 0	00 0	01 0	00 0	04 0	00 0	00 0	15 0	15 0	15 0	15 0	15 0	15 0
201	027	21931945	O K	11	00	04 0	04 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	15 0	15 0	11 0	11 0
						09 0	00 0	04 0	12 0	04 0	15 0	12 0	13 0	00 0	14 0	13 0	03 0	12 0	13 0	13 0	02 0
201	027	21933224	O K	12	00	16 0	16 0	00 0	01 0	06 0	12 0	00 0	01 0	00 0	06 0	00 0	08 0	01 0	00 0	05 0	00 0
						08 0	01 0	13 0	05 0	00 0	00 0	02 0	00 0	08 0	12 0	15 0	01 0	00 0	13 0	14 0	15 0
201	027	21934502	O K	13	00	02 0	02 0	11 0	02 0	15 0	15 0	01 0	15 0	11 0	04 0	15 0	05 0	00 0	00 0	00 0	03 0
						01 0	09 0	08 0	10 0	00 0	01 0	02 0	06 0	04 0	05 0	00 0	05 0	02 0	05 0	09 0	06 0
201	027	21935780	O K	14	00	16 0	16 0	00 0	01 0	03 0	12 0	00 0	01 0	00 0	00 0	00 0	00 0	10 0	13 0	09 0	13 0
						15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	11 0	02 0	07 0	00 0	00 0	00 0
201	027	21937059	O K	15	00	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	14 0	15 0	07 0	07 0	14 0	15 0	07 0	03 0
						00 0	00 0	08 0	14 0	01 0	15 0	12 0	13 0	00 0	14 0	15 0	13 0	10 0	02 0	10 0	08 0
201	027	21938337	O K	16	00	16 0	16 0	00 0	01 0	02 0	12 0	00 0	01 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0
						00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	00 0	02 0	07 0	07 0	02 0
201	027	21939615	O K	01	06	14 3	14 3	09 3	01 2	07 3	00 3	07 3	01 2	07 3	00 3	07 3	01 2	07 3	11 3	08 3	01 2
						07 3	00 3	04 3	01 2	07 3	00 3	04 3	01 2	08 3	04 3	10 3	00 3	07 3	01 2	00 3	00 3
201	027	21940894	O K	02	06	16 3	16 3	00 3	01 3	07 3	12 3	00 3	01 3	00 3	00 3	00 3	00 3	10 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
201	027	21942172	O K	03	06	12 3	12 3	00 3	00 3	00 3	00 3	00 3	00 3	14 3	15 3	11 3	07 3	14 3	15 3	11 3	07 3
						12 3	10 3	15 3	07 3	04 3	15 3	12 3	13 3	00 2	02 3	02 3	00 2	00 3	00 3	15 3	15 3
201	027	21943450	O K	04	06	16 3	16 3	00 3	01 3	00 3	12 3	00 3	01 3	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2
						00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	13 3	14 3	15 3
201	027	21944729	O K	05	06	10 3	10 3	08 3	07 3	15 3	05 3	07 3	03 3	11 3	07 3	00 2	07 3	11 3	06 3	07 3	02 3
						13 3	01 2	08 3	09 3	09 3	01 3	09 3	07 3	15 3	06 3	01 2	09 3	11 3	04 3	02 3	09 3
201	027	21946007	O K	06	06	16 3	16 3	00 2	01 3	02 3	12 3	00 2	01 3	00 2	00 2	15 3	15 3	10 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	02 2	11 3	00 2	02 3	00 2	00 3
201	027	21947285	O K	07	06	08 3	08 3	00 2	00 3	00 2	00 3	00 3	00 3	00 2	00 3	08 3	00 2	00 2	00 3	08 3	04 3
						01 3	00 3	12 3	14 3	06 3	00 2	10 3	02 3	00 2	14 3	00 2	08 3	04 3	07 3	04 3	14 3
201	027	21948564	O K	08	06	16 3	16 3	00 2	01 3	05 3	12 3	00 2	01 3	00 2	00 3	00 3	00 3	00 3	00 3	00 3	00 3
						00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	02 3	07 3	07 3	03 2
201	027	21949842	O K	09	06	06 3	06 3	08 3	04 3	03 3	13 3	01 3	03 3	13 3	02 3	03 3	13 3	03 3	03 3	13 3	03 3
						08 3	13 3	04 3	03 3	15 3	05 3	03 3	13 3	06 3	03 3	13 3	06 3	03 3	13 3	07 3	03 3

Figure Intermediate Tape Print

TF	DOY	TIME MILLISEC	DELTA T	FM	CL.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
201	027	Z1951121	0 K	10	06	16 3	16 3	00 3	01 2	04 3	12 3	00 3	01 2	00 3	00 3	00 3	00 3	10 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
201	027	Z1952309	0 K	11	06	04 3	04 3	00 3	00 3	00 3	00 3	00 3	00 3	14 3	15 3	11 3	07 3	14 3	15 3	11 3	07 3
						05 3	00 2	00 3	15 3	03 3	10 3	02 2	00 2	00 3	14 3	13 3	03 3	13 3	13 3	13 3	02 3
201	027	Z1953678	0 K	12	06	16 3	16 3	00 3	01 3	12 3	11 3	00 2	01 3	00 3	00 2	00 3	04 3	11 3	00 2	00 3	00 2
						00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	13 3	14 3	06 3
201	027	Z1954950	0 K	13	06	02 3	02 3	04 3	13 3	15 3	15 3	01 3	02 3	07 3	04 2	15 3	05 3	00 2	00 2	00 2	03 2
						00 2	01 2	00 2	01 3	00 2	01 3	00 2	01 3	00 2	01 3	00 2	01 3	05 2	02 3	00 2	01 3
201	027	Z195625[illegible]	0 K	14	06	16 3	16 3	00 2	01 3	15 3	11 3	00 2	01 3	00 2	00 3	00 2	00 3	10 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
201	027	Z1957513	0 K	15	06	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	00 3	00 3	08 3	00 3	00 3	00 3	08 3	04 3
						01 2	00 3	00 3	14 3	01 2	00 3	03 3	00 3	00 3	14 3	15 3	13 3	10 3	02 3	10 3	08 3
201	027	Z1958791	0 K	16	06	16 3	16 3	00 3	01 2	00 3	12 3	00 2	01 2	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3
						00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	02 3	07 3	07 3	03 2
201	027	Z1960000	0 K	01	06	14 2	14 2	05 2	01 2	07 2	00 2	04 2	01 2	07 3	00 2	05 3	01 2	07 3	14 3	02 2	01 2
						07 3	00 2	06 3	01 2	07 3	09 3	06 3	01 2	08 3	05 3	10 3	00 2	11 3	11 3	00 2	00 3
201	027	Z1961348	0 K	02	06	16 3	16 3	00 2	01 2	03 2	12 3	00 2	01 2	00 3	00 3	00 3	00 3	09 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
201	027	Z1962620	0 K	03	06	12 3	12 3	00 2	00 2	00 3	00 2	00 3	00 2	00 3	08 3	15 3	00 2	00 3	08 3	15 3	00 2
						01 2	01 3	04 2	03 3	00 2	05 3	03 2	00 2	05 3	10 3	03 2	00 2	01 2	00 2	15 3	15 3
201	027	Z1963904	0 K	04	06	16 3	16 3	00 2	01 2	03 2	12 3	00 2	01 2	00 2	13 3	02 2	00 2	00 2	00 2	00 2	00 2
						00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	00 2	13 3	14 3	15 3
201	027	Z1965183	0 K	05	06	10 3	10 3	14 3	08 3	15 3	05 3	07 3	03 2	11 3	07 3	00 2	06 3	11 3	06 3	07 3	02 2
						13 3	01 2	07 3	09 3	09 3	01 2	09 3	07 2	10 3	10 3	15 3	08 3	04 2	04 3	15 3	08 2
201	027	Z1966461	0 K	06	06	16 3	16 3	00 2	01 2	04 3	12 3	00 2	01 2	00 2	00 2	00 2	00 3	09 3	13 3	09 3	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
201	027	Z1967739	0 K	07	06	08 3	08 3	00 2	00 3	00 2	00 3	00 2	00 2	14 3	15 3	07 3	07 3	14 3	15 3	07 3	03 3
						00 2	00 3	00 3	15 3	04 2	13 3	09 3	01 2	05 3	00 2	11 3	00 2	03 2	00 3	15 3	15 3
201	027	Z1969013	0 K	08	06	16 3	16 3	00 2	01 2	04 3	12 3	00 2	01 2	00 2	00 3	00 3	00 3	01 2	00 3	00 3	00 3
						00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 3	02 2	07 3	07 3	04 2
201	027	Z1970290	0 K	09	06	06 3	06 3	08 3	04 3	03 3	13 3	01 2	03 2	13 3	02 2	03 3	13 3	03 2	03 3	13 3	03 3
						03 3	13 3	04 2	03 3	13 3	05 3	03 3	13 3	06 3	03 3	13 3	06 2	03 3	13 3	07 2	03 2
201	027	Z1071575	0 K	10	06	16 3	16 3	00 2	01 2	01 2	12 3	00 2	01 2	00 3	00 3	15 3	15 3	10 3	13 3	09 2	13 3
						15 3	00 2	12 3	03 2	00 2	02 2	00 2	08 3	00 2	00 2	15 3	15 3	15 3	15 3	15 3	15 3
201	027	Z1972853	0 K	11	06	04 2	04 3	00 2	00 2	00 3	00 2	00 3	00 2	00 3	08 3	15 3	00 2	00 2	08 3	15 3	00 2
						11 3	00 2	00 2	00 2	00 2	13 3	03 2	06 3	05 3	00 2	01 2	00 2	01 2	00 2	15 3	15 3
201	027	Z1974120	0 K	12	06	16 3	16 3	00 2	01 2	01 3	12 3	00 2	01 2	15 3	05 2	00 2	08 3	01 2	00 2	06 2	00 2
						08 3	01 2	13 3	05 2	00 2	00 2	02 2	00 2	08 3	00 2	00 3	02 2	10 3	03 2	12 3	15 3
201	027	Z1975407	0 K	13	06	02 2	02 3	11 3	02 2	15 3	15 3	01 2	14 3	08 2	04 2	15 3	05 2	00 2	00 2	00 3	03 2
						14 3	08 2	13 2	09 2	00 2	01 2	01 3	06 2	04 2	05 2	00 2	05 3	02 2	05 2	08 3	06 2
201	027	Z1976680	0 K	14	06	16 3	16 3	00 2	01 2	13 2	11 3	00 2	01 2	00 2	00 2	08 3	08 3	10 2	13 3	07 2	04 2
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	03 2	00 2	00 2	00 3	00 2	00 3
201	027	Z19770 6[illegible]	0 K	15	06	00 2	00 3	00 2	00 3	00 2	00 3	00 2	00 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3
						00 2	00 3	00 2	02 2	00 2	03 2	15 3	09 2	05 2	08 3	11 3	00 2	03 2	00 2	15 3	15 3
201	027	Z19792[illegible]Z	0 K	16	06	16 3	16 3	00 2	01 2	03 2	12 3	00 2	01 2	00 2	00 3	00 3	00 3	01 2	00 2	00 2	00 3
						00 2	00 3	00 2	00 3	00 3	00 3	00 3	00 3	00 3	00 3	00 2	00 3	02 2	07 3	07 3	04 2
201	027	Z1980521	0 K	01	06	14 2	14 3	06 2	01 2	07 2	14 2	10 3	01 2	07 3	00 2	07 3	01 2	07 3	11 3	08 3	01 2
						07 3	00 2	08 3	01 2	07 3	00 2	08 3	01 2	08 3	06 3	10 3	00 2	00 3	00 3	00 3	00 3
201	027	Z19817 9	0 K	02	06	16 3	16 3	00 2	01 2	01 3	12 3	00 2	01 2	00 2	00 3	00 3	00 3	09 3	13 3	09 2	13 3
						15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3	15 3

CORRELATOR NO. AND QUALITY FLAGS IN 16 GROUPS PER LINE
ASTERISK FOLLOWING CORRELATOR INDICATES LOSS OF SYNC.

Figure III-5 (Continued) Sample Intermediate Tape Print-Out Part 2

```
PROGRAM VERSION OF MARCH 28,1967.                              QUALITY CONTROL LISTING FOR IMP F9

INTERMEDIATE TAPE FILE NUMBER        1
                                     YR MO DA HR MN SE
           ANALOG START TIME         67 01 27  6 05 35       DIGITAL START TIME       6 05 39          BCD TIME
           ANALOG STOP TIME                    8 04 18       DIGITAL STOP TIME        8 04 17       GOOD      BAD
           ANALOG TAPE NUMBER             3203               DIGITAL TAPE NUMBER        447         5101      490
ORBIT NUMBER          1  STATION NUMBER        16    OPERATOR          TIME           DATE   / /
TOTAL SAMPLES RECOVERED        GOOD      FAIR      POOR     UNDETERMINED
          178688             144050     34638        0            0
PERCENT                      80.63%    19.37%     0.00%        0.00%
TOTAL FRAMES RECOVERED                    5591
TOTAL FRAMES EXPECTED                     5583
PERCENT FRAME RECOVERY                  100.00%
           PERCENT     TOTAL SEQUENCES
           0.00%              2         ONE ERROR IN 100 OR MORE
           2.86%             13         ONE ERROR IN 330
           8.91%             31         ONE ERROR IN 500
          87.32%            381         ONE ERROR IN 1000 OR LESS
DELTA T EXCEEDED TOLERANCE           0  TIMES
PHASE SYNC LOST                      0  TIMES
SEQUENCE SYNC LOST                   0  TIMES
PARITY ERRORS                 0
TAPE UNIT - PROCESSING  000A     RECORDING    0000000041
PROCESS NUMBER                1
FRONT-END MALFUNCTION       00NO
```

Figure III-5 (Continued). Sample Intermediate Tape Print - Sheet 3

This CL is the channel number at which time was sampled from the Time Decoder. To correct the frame-time back to Channel 1, simply multiply the CL number by the nominal channel-time (40 milliseconds) and subtract from the result the TIME MILLISEC number.

The channels within a frame are numbered from 1 to 32; sixteen appear on each line, Each channel value is represented by a two-digit decimal number; the one-character column following each channel value is the two-bit octal data-quality flag. These flags are:

11	3_{10}	good data
10	2	fair data
01	1	poor data
00	0	undetermined quality

The time on the printout shown for the first orbit block for each file is incorrect. The pseudo-sequence count slipped between the 1st and 2nd files; it is consistent within each file: but is affected by one count in the 2nd file. Only two pages of the intermediate tape print plus the Quality Control Listing page are shown in Figure III-5: the complete intermediate tape printout runs to many pages.

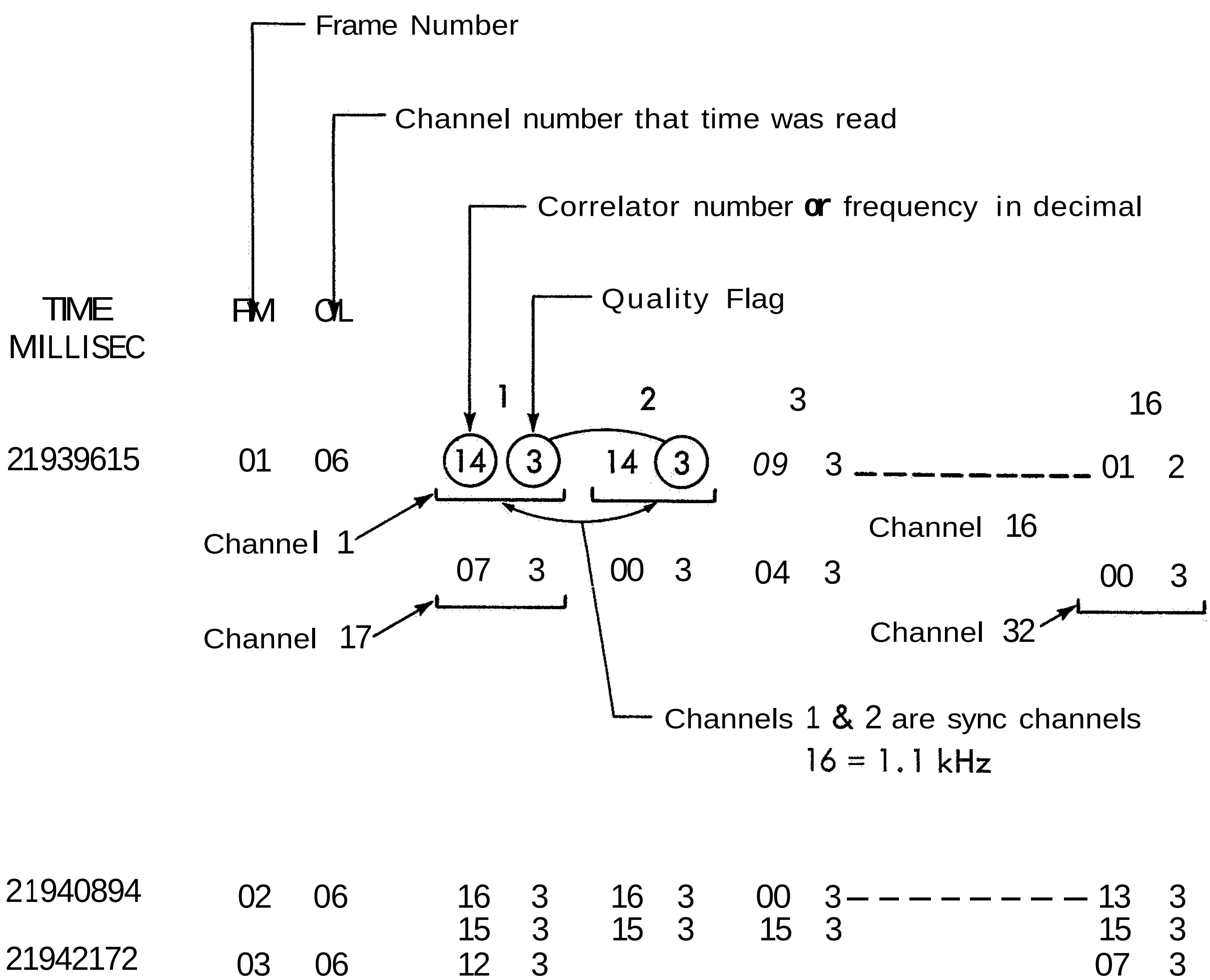
Figure III-6 provides a pictorial description of the listings on the printout (See also Figure III-7).

3.4 F-9 BUFFER PRINT (IF9BUPNT) PROGRAM

This program dumps the binary F-9 buffer tape on the printer; two formats are available. Figure III-8 shows a sample printout.

3.5 DIGITAL DIRECT IMP-F PRINT (DIMPFPNT) PROGRAM

This program operates when the front-end is in the digital sync mode. The program makes it possible to check the digitized values of each channel by writing directly on the printer or by storing the data on tape; two printer formats are available. By option, the data is stored on tape or outputed on the printer. Proper channel sync is established, phase sync loss is monitored: and when phase loss occurs sync is re-acquired. Figure III-9 shows a typical program printout.



NOTE

The Satellite Clock in Frames 8 and 16 is reversed on the Intermediate Tape Print; read the most-significant-bit first. For example:

	Ch29	Ch30	Ch31	Ch32
Frame 8 →	02 3	07 3	07 3	03 2
Binary:	0010	0111	0111	0011
Octal:	2	3 5	6	3
Decimal:	10099			

Figure III-6. Description of Listings on Intermediate Tape Print

A. IDENTIFICATION

IF9INTPT - COMPASS 32
R. W. NELSON, CODE 542, JANUARY 6,1967.
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

INTERMEDIATE TAPE PRINT ROUTINE FOR THE F-9 PROCESSING LINE. ROUTINE WILL OBTAIN DATA FROM INTERMEDIATE TAPES AND PRINT OUT ON LINE PRINTER CONTENTS OF THE TAPE WITH AN OPTION OF THREE DIFFERENT FORMATS. FORMAT NO. 1 PRINTS ONE FRAME EVERY TWO LINES WITH TIME, FRAME NUMBER, CHANNEL NUMBER, CHANNEL VALUES, AND QUALITY CONTROL FLAGS. FORMAT NO. 3 IS SIMILAR TO FORMAT NO. 1 EXCEPT THAT ONE FRAME IS PRINTED PER LINE AND NO QUALITY CONTROL FLAGS ARE INCLUDED. BOTH FORMATS PRINT ONE TWO-LINE IDENTIFICATION RECORD AND ONE SUMMARY RECORD PER FILE. FORMAT NO. 2 IS AN OCTAL DUMP OF THE CONTENTS OF THE BINARY TAPE.

C. USAGE

1. SPACE REQUIREMENTS - 2 BANKS.
2. CONFIGURATION REQUIREMENTS - 1 SYSTEM TAPE, 1 INTERMEDIATE TAPE, CARD READER, LINE PRINTER.

D. OPERATING INSTRUCTIONS

1. EQUIP CARD IS USED TO DENOTE CHANNEL AND UNIT NUMBERS OF INTERMEDIATE TAPE. LOGICAL UNIT 31 IS USED IN THE ROUTINE FOR INPUT.
2. LOAD PROGRAM BY CALLING F9INTPT
3. OPTIONS

   SJ1 PRINTS FORMAT NO. 1
   SJ2 PRINTS FORMAT NO. 2 AND OVERRIDES ANY OTHER JUMP SWITCH
   SJ3 PRINTS FORMAT NO. 3
   (IF NO JUMP SWITCHES ARE ON, FORMAT NO. 1 WILL BE PRINTED)
   FILES AND RECORDS MAY BE SKIPPED BY REPLY TO QUESTIONS ON TYPEWRITER. THE NUMBER OF RECORDS TO BE PRINTED IS INDICATED IN THE SAME MANNER.

E. TECHNICAL NOTES

IF CHANNEL 5 IS USED FOR INPUT, USE TAPE UNIT 0. IF ANY UNIT OTHER THAN 0 IS EQUIPPED, UNUSED TAPE UNITS ON CHANNEL 5 MUST BE DIALED TO STAND-BY POSITION.

Figure III-7. F-9 Intermediate Tape Print

A. IDENTIFICATION

IF9BUPNT - COMPASS 3%
C. K. CAPPS, CODE 542, 17 JANUARY 1967.
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

THIS PROGRAM PRINTS TAPES WHICH AHE IN THE F9 BUFFER TAPE FORMAT. F9 BUFFER TAPES ARE GENERATED BY THE DIMPFPNT PROGRAM, BY THE AIMPFPNT PROGRAM, OH BY THE F9 BUFFER). TWO PHINTEH FORMATS ARE SELECTED ON SJ1. THE POSITION OF THE TIME SAMPLE WITHIN THE FRAME IS INDICATED WITH A PERIOD(.) BETWEEN OATA SAMPLES. LOSS OF PHASE SYNC IS INDICATED WITH AN ASTERISK (*) PRECEEDING THE OATA SAMPLE IN WHICH SYNC LOSS OCCURED. THE W2 AND W4 VALUES ARE CONVERTED TO APPROXIMATE VOLTS AND MULTIPLIED BY TEN BEFORE PRINTING.

C. USAGE

1. SPACE REQUIREMENTS - 2 BANKS
2. CONFIGURATION REQUIREMENTS
   1 SYSTEM TAPE, CARD READER, LINE PRINTER, INPUT TAPE ON CHANNEL 1, UNIT 2.

D. OPERATING INSTRUCTIONS

1. LOAD THE BINARY PROGRAM DECK WITH AUTOLOAD.
2. READY INPUT TAPE ON CHANNEL 1, UNIT 2.
3. SELECT THE DESIREU PRINTER FORMAT.
4. PRESS GO, AND ANSWER QUESTIONS ON THE TYPEWRITER.
5. OPTIONS
   SJ1 SELECTS THE PRINTER FORMAT
   ON = FORMAT B   W1,W2,W3,W4 ALL PRINT.
   Off = FORMAT A   W1 ONLY PRINTS.

E. TECHNICAL NOTES

Figure III-8. F-9 Buffer Print

TF		TIME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
			DATA (W1 ONLY) BUFFER PRINT																															
10Z	000	40687891	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
10Z	000	40689172	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10
10Z	000	40690452	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
10Z	000	40691733	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
10Z	000	40693013	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
10Z	000	40694294	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
10Z	000	40695574	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
10Z	000	40696854	16	16	06	10	04	04	12	07	14	00	03	13	06	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
10Z	000	40698135	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
10Z	000	40699415	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
102	000	40700696	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
102	000	40701976	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
102	000	40703256	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
102	000	40704537	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
102	000	40705817	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
102	000	40707097	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
102	000	40708377	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
102	000	40709657	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10
102	000	40710938	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
102	000	40712218	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
102	000	40713499	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
102	000	40714779	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
102	000	40716059	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
102	000	40717340	16	16	06	10	04	04	12	07	14	00	03	13	06	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
102	000	40718620	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
102	000	40719901	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
102	000	40721181	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
102	000	40722461	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
102	000	40723741	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
102	000	40725021	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
102	000	40726302	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
102	000	40727582	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
102	000	40728862	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
102	000	40730142	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10
102	000	40731422	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
102	000	40732703	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
10Z	000	40733983	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
10Z	000	40735263	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
10Z	000	40736543	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
10Z	000	40737823	16	16	06	10	04	04	12	07	14	00	03	13	06	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
10Z	000	40739104	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
10Z	000	40740384	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
10Z	000	40741664	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
10Z	000	40742945	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
10Z	000	40744225	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
10Z	000	40745506	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
10Z	000	40746786	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
10Z	000	40748067	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
10Z	000	40749347	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
10Z	000	40750627	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10

INDICATES FRAME AND SEQUENCE SYNC

Figure III-8 (Continued). F-9 Buffer Print - Sheet 2

```
                                         DATA (W1, W2, W3, W4)(W2 AND W4 CONVERTED TO VOLTS) BUFFERPOINT
      1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32

W1   14  14  00  00  01  01  02  02  03  03  04  04  03  05  06  06  07  07  08  03  09  09  10  10  11  11  12  12  13  13  14  14
W2  046 046 036 040 046 043 043 043 043 043 043 043 043 043 043 043 043 043 046 043 046 046 046 046 046 046 050 046 046 046 046 046
W3   00  00  13  14  00  00  00  02  00  00  00  04  00  00  00  15  00  07  00  00  00  00  00  10  00  00  00  12  00  00  00  00
W4  003 003 003 003 003 003 003 000 003 003 003 000 003 003 003 003 003 000 003 003 003 003 003 000 003 003 003 000 003 003 003 003

TF= 102     DOY= 000     MSEC=41018208

W1   16  16  00  01  02  03  04  05  06  07  08  09  10  11  12  13  14  15  00  01  02  03  04  03  06  07  08  09  10  11  12  13
W2  050 046 040 043 043 043 043 043 043 043 046 046 046 046 046 043 046 046 036 043 043 043 043 043 043 043 046 046 046 006 050 046
W3   00  00  13  00  00  00  00  00  00  00  00  00  00  00  00  00  00  00  13  00  00  00  00  00  00  00  00  00  00  00  00  00
W4  006 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003 003

TF= 102     DOY= 000     MSEC=41019488

W1   12  12  01  00  03  02  05  04  07  06  09  08  11  10  13  12  13  14  14  15  00  01  02  03  04  06  05  10  12  14  15  00
W2  050 046 043 040 043 043 046 043 046 043 046 046 046 046 046 046 043 046 046 046 036 043 043 043 043 043 043 046 046 046 046 040
W3   00  14  00  01  00  03  00  14  00  00  00  00  00  11  00  13  00  15  00  00  15  00  00  00  00  00  00  08  00  12  00  13
W4  003 003 003 000 003 000 003 003 003 003 003 003 003 000 003 000 003 000 003 003 000 003 003 003 003 003 003 000 003 000 003 000

TF= 102     DOY= 000     MSEC=41020.69

W1   16  16  06  03  10  12  14  15  12  05  14  13  00  04  14  04  00  05  02  12  09  07  09  02  13  13  09  07  10  12  02  00
W2  050 046 043 043 046 046 046 046 046 043 046 046 036 043 043 043 036 046 043 046 046 043 046 043 046 046 046 043 046 046 043 040
W3   00  00  00  00  00  14  00  14  00  00  00  00  13  00  00  14  04  00  00  02  00  00  00  09  00  00  00  00  00  15  00  02
W4  006 003 003 003 003 003 003 000 003 003 003 003 003 000 003 000 000 003 003 000 003 003 003 000 003 003 003 003 003 003 003 000

TF= 102     DOY= 000     MSEC=41022049

W1   10  10  08  15  01  14  02  10  15  04  00  12  08  14  10  03  15  09  06  04  09  04  01  10  00  08  02  13  00  07  09  06
W2  046 046 046 046 043 046 043 046 046 043 036 046 046 046 046 043 046 046 043 043 046 043 043 046 036 046 043 046 036 043 046 043
W3   00  10  00  14  00  00  00  02  00  15  04  00  00  00  00  00  00  00  00  06  00  14  00  01  13  00  00  00  13  00  00  00
W4  003 000 003 003 003 003 003 000 003 000 000 000 003 003 003 003 003 003 003 000 003 003 003 000 003 003 003 003 000 003 003 003

TF= 102     DOY= 000     MSEC=41023329


SUBP
 24412  TDIWEDEV     24714  BUFFPRNT    34110  DUMPAOTB    34571  F9DI ECO

ENTR
 24632  SINCOS       24500  AZIMUTH     24470  ARCCOS      24461  ARCE        24453  CO          24413  SINX
 24714  F9PRNT       34535  LASTSS      34534  FIRSTSE     34110  STDE T      24557  SQ ROT      34571  BEGEN
 01012  SEL          03376  UST         03436  CST         00060  CIO         03507  RH T        03447  AET
 03650  RDCKSUM      03553  RDCKF1      00107  CIO         03721  STDD 2      04220  LO BER      03527  ACCOUNTS
 03551  MEMORY       03263  ABNORMAL

COMM
 04454   04463

DATA
     NONE

EXTA
     NONE
```

Figure III-8 (Continued) F-9 Buffer Print - Sheet 3

A IDENTIFICATION

DIMPFPNT - COMPASS 32
C. K. CAPPS, CODE 542, f7 JANUARY 1967.
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

THIS PROGRAM PRINTS THE DIGITIZED VALUES FROM THE F9 ANALOG DATA PROCESSING LINE. IT WILL ASSEMBLE DATA IN FRAME BLOCKS, AND OPTIONALLY STORE THESE FRAMES ON TAPE AND/OR WRITE THE SAME FRAME ON THE PRINTER. THIS PROGRAM OPERATES ONLY WHEN THE F9 LINE IS IN THE DIGITAL SYNC MOUE. ONE OF TWO FORMATS MAY BE SELECTED FOR THE PRINTER. DUE TO THE PRINTER SPEEU ONLY THE FORMAT WHICH PRINTS W1 VALUES, ONE FHAME PER LINE, WILL OPERATE WITHOUT LOSING OATA SAMPLES. THIS PROGRAM OPERATES AT 1C, 2C, OR 4C, BUT LOSES DATA SAMPLES IF OUTPUT IS ON PRINTER FOR ANYTHING ABOVE 1C. THE W2 AND W4 VALUES WHEN PRINTEU ARE CONVERTED TO APPROXIMATE VOLTS AND MULTIPLIEO BY TEN BEFORE PRINTING. CHANNEL SYNC IS ESTABLISHED AND MAINTAINED. PHASE SYNC LOSSES ARE MONITORED AND FLAGGED. THE OUTPUT TAPE IS WRITTEN IN THE F9 BUFFER TAPE FORMAT.

C. USAGE

1. SPACE REQUIREMENTS - 2 HANKS
2. CONFIGURATION REQUIREMENTS
   1 SYSTEM TAPE, CARD READER, LINE PRINTER, TAPE ON CHANNEL 1, UNIT 2 IF *TAPE* OUTPUT DESIRED.

D. OPERATING INSTRUCTIONS

1. SET UP F9 LINE FOH UIGITAL SYNC MODE WITH EITHER SIMULATOR OR ANALOG TAPE INPUT.
2. LOAD THE BINARY PROGRAM DECK WITH AUTOLOAD.
3. HEAUY OUTPUT TAPE OIL CHANNEL 1, UNIT 2 IF TAPE UUTPUT DE4IRED.
4. READY FILE IDENTIFICATION CARD IN CASU HEADER. (ONE PARAMETER CARD FOR EACH TAPE FILE.) THE PARAMETER CARD IS FREE FORM, ONLY THE FIRST 18 COLUMNS ARE STORED IN I. D. RECORD.
5. SELECT DESIRED OUTPUT WITH SELECT-JUMP SWITCH.
6. PRESS GO, AND ANSWEH QUESTIONS ON THE TYPEWHITEH.
7. OPTIONS
   SJ1 SELECTS PRINTER FORMAT
   ON=FORMAT B, W1,W2,W3,W4.
   OFF=FORMAT A, W1 ONLY.
   SJ3 = OPTION TO WRITE TAPE AND PRINTER.
   SJ4 = OPTION TO WRITE TAPE OR PHINTEH.
   OFF=TAPE ONLY.
   SJ5 = SYNC OPTION.
   ON=SYNC BEGIN OF PRINT ON SEQUENCE.
   OFF=SYNC BEGIN OF PRINT ON FRAME.
   SJ6 = WRITE END OF FILE ON TAPE.

8. PERTINENT REGISTERS

9. AFTER WRITING E.O.F. ON TAPE, PUSH SJ6 TO OFF, READY I. D. CARD IN CARD READER AND PUSH GO TO CONTINUE.

E. TECHNICAL NUTES

Figure III-9. Digital Direct IMP-F Print

3.6 ANALOG DIRECT IMP-F PRINT (AIMPFPNT) PROGRAM

This program operates when the F-9 Processor Line is in the analog mode. The data is stored on tape or on the printer. Phase sync is not established or maintained by the computer. Figure **III-10** shows a typical program printout.

3.7 F-8 BUFFER TAPE PRINT (IF8BUPNT) PROGRAM

This program dumps binary F-8 buffer tapes on the printer (See Figure III-11).

3.8 F-9 SEMI-AUTOMATIC **DIAGNOSTIC** (F9SAD) PROGRAM

This program is a diagnostic routine for the F-9 Processor Line. Calls for digital version (F9SAD, D.) or analog version program (F9SAD, A.) will accept data from the F-9 line in a known sequence standard data (SD) format and compare with the stored SD format. Errors are tabulated and the data is classified with a quality control subroutine and tabulated under three classes of **"good", "fair",** and "poor". After a predetermined number of sequences have been processed, the program terminates with a summary print.

Call for digital version time-analysis (F9SAD, DT.) and analog version time-analysis (F9SAD, AT.) programs receive time from the F-9 Line and perform a statistical difference-table analysis. When a time occurs that exceeds normal. the time with its differences is printed on the line printer. Figure III-12 shows a sample printout,

3.9 FILE MANAGEMENT (F9FILMGT) PROGRAM

This program enables an analyst to manipulate files from up to three input tapes to produce an output tape that will be correct for submission to a desired following program. The analyst may also call for quality information to be plotted or listed from the input tapes. Figure III-13 shows a sample printout.

3.10 F-8 BUFFER MODE PROCESSING PROGRAM

3.10 ,1 Introduction

The F-8 analog-to-digital telemetry line is used as a back-up to the prime F-9 Line for the IMP-F satellite. In order **for** the IMP-F Decommutation Program to process data digitized by the F-8 Line, it is necessary that the data tapes be in the proper format, i.e., the Intermediate Data Tape. Most of the functions performed by the F-9 On-Line Processing Program are done by the **E-8** Buffer Mode Processing Program in a non real-time mode.

A. IDENTIFICATION

AIMPFPNT - COMPASS 32
C. K. CAPPS, CODE 542, 17 JANUARY 1967
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

THIS PROGRAM PRINTS THE DIGITIZED VALUES FROM THE F9 ANALOG DATA PROCESSING LINE. IT WILL ASSEMBLE DATA IN FRAME BLOCKS AND OPTIONALLY STORE THESE FRAMES ON TAPE AND/OR WRITE THE SAME FRAME ON THE PRINTER. THIS PROGRAM OPERATES ONLY WHEN THE F9 LINE IS IN THE ANALOG SYNC MODE. ONE OF TWO PRINTER FORMATS MAY BE SELECTED WITH THE SELECT-JUMP SWITCH. DUE TO THE PRINTER SPEED ONLY THE FORMAT WHICH PRINTS THE W1 VALUES, ONE FRAME PER LINE, WILL OPERATE WITHOUT LOSING DATA SAMPLES. THIS PROGRAM OPERATES AT 1C, 2C, OR 4C, BUT LOSES DATA SAMPLES IF OUTPUT IS ON PHINTER FOR ANYTHING ABOVE 1C. THE W2 AND W4 VALUES ARE CONVERTED TU APPROXIMATE VOLTS AND MULTIPLIED BY TEN BEFORE PRINTING. CHANNEL SYNC IS LEFT TO THE F9 LINE. THE TAPE IS WRITTEN IN THE F9 BUFFER TAPE FORMAT.

C. USAGE

1. SPACE REQUIREMENTS - 2 BANKS
2. CONFIGURATION REQUIREMENTS
   1 SYSTEM TAPE, CARD READER, LINE PRINTER, TAPE ON CHANNEL 1, UNIT 2 IF TAPE OUTPUT DESIRED.

D. OPERATING INSTRUCTIONS

1. SET UP THE F9 LINE FOR ANALOG SYNC MODE WITH EITHER SIMULATOR OR ANALOG TAPE INPUT.
2. LOAD THE BINARY PROGRAM UECK WITH AUTOLOAD.
3. READY OUTPUT TAPE ON CHANNEL 1, UNIT 2 IF TAPE OUTPUT IS DESIRED.
4. READY FILE IDENTIFICATION CARD IN THE CAHD READER. (ONE PAHAMETEH CAHO FOR EACH FILE.) THE PAHAMETEH CAHD IS FREE FORM, ONLY THE FIRST 18 COLUMNS ARE STORED IN THE TAPE I.D. RECORD.
5. SELECT THE DESIRED OUTPUT WITH SELECT-JUMP SWITCH.
6. PRESS GO, AND ANSWER QUESTIONS ON THE TYPEWRITER.
7. OPTIONS
   SJ1 SELECTS THE PRINTER FORMAT.
      ON=FORMAT B W1,W2,W3,W4 ALL PRINT.
      FORMAT A W1 ONLY PRINTS.
   SJ3 OPTION TO WRITE TAPE AND PRINTER.
      OFF=TAPE Off PHINTEH OUTPUT.
      ON=TAPE AND PRINTER.
   SJ4 ON=PRINTER OUTPUT
        OFF= TAPE OUTPUT
   SJ5 = SYNC OPTION
      ON=BEGIN PRINTING WITH START OF SEQUENCE'
      OFF=BEGIN PRINTING WITH START OF FRAME.
   SJ6 = WRITE END OF FILE ON TAPE.
8. PERTINENT REGISTERS
9. AFTER WRITING E.O.F. ON TAPE, PUSH SJ6 TO OFF, READY I.D. CARD IN CARD READER, AND PUSH GO TO CONTINUE.

E. TECHNICAL NOTES

Figure III-10. Analog Direct IMP-F Print

(ANALOG)

TF	DOY	MILLISEC	1	2	3	4	5	6	7	8	9 10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
102	000	37960413	04	06	09	13	03	07	15	00	08.09	14	05	13	01	14	12	12	05	06	09	07	01	15	02	16	16	03	04	05	11	08	05
102	000	37961693	03	07	01	06	06	12	08	05	01.12	11	00	15	03	14	11	10	10	15	00	09	15	04	13	00	00	04	02	01	13	06	12
102	000	37962974	07	04	05	12	14	10	07	15	11.09	04	03	00	10	08	11	14	05	09	13	10	08	12	14	16	16	08	06	01	15	02	03
102	000	37964254	10	11	00	07	04	10	01	11	02.07	02	11	11	05	10	12	05	06	03	01	00	06	15	10	14	14	00	00	01	01	02	02
102	000	37965535	03	03	04	04	05	05	06	06	07.07	08	08	09	09	10	10	11	11	12	12	13	13	14	14	16	16	00	01	02	03	04	05
102	000	37966815	06	07	08	09	10	11	12	13	14.15	00	01	02	03	04	05	06	07	08	09	10	11	12	13	12	12	01	00	03	02	05	04
102	000	37968096	07	06	09	08	11	10	13	12	15.14	14	15	00	01	02	03	04	06	08	10	12	14	15	00	16	16	06	08	10	12	14	15
102	000	37969376	12	05	14	13	00	04	14	04	00.05	02	12	09	07	09	02	13	13	09	07	10	12	02	00	10	10	08	15	01	14	02	10
102	000	37970656	15	04	00	12	08	14	10	03	15.09	06	04	09	04	01	10	00	08	02	13	00	07	09	06	16	16	06	10	04	04	12	07
102	000	37971936	14	00	03	13	06	02	14	05	00.02	13	11	04	10	09	07	10	03	15	13	04	06	01	08	08	08	13	11	06	08	10	11
102	000	37973216	02	15	05	09	14	15	01	07	10.07	15	13	09	13	14	11	00	12	07	08	05	11	02	12	16	16	00	03	04	14	03	04
102	000	37974496	14	13	03	11	10	05	06	04	14.08	03	15	06	02	02	08	13	00	11	15	06	11	01	15	06	06	13	09	02	09	07	15
102	000	37975776	00	13	08	10	12	08	04	08	07.00	12	06	14	08	00	13	08	12	07	11	08	10	14	08	16	16	01	03	14	04	05	11
102	000	37977057	04	12	03	00	06	03	11	12	09.05	01	09	14	04	08	10	03	04	05	01	05	08	01	15	04	04	09	10	13	07	01	05
102	000	37978337	13	11	01	07	15	01	01	10	11.12	12	07	08	12	05	06	13	14	10	13	13	09	01	05	16	16	01	13	06	00	04	13
102	000	37979618	05	03	09	11	02	04	12	03	02.04	09	08	02	06	10	06	00	02	03	07	14	03	06	12	02	02	01	09	04	05	15	00
102	000	37980898	04	06	09	13	03	07	15	00	08.09	14	05	13	01	14	12	12	05	06	09	07	01	15	02	16	16	03	04	05	11	08	05
102	000	37982179	03	07	01	06	06	12	08	05	01.12	11	00	15	03	14	11	10	10	15	00	09	15	04	13	00	00	04	02	01	13	06	12
102	000	37983459	07	04	05	12	14	10	07	15	11.09	04	03	00	10	08	11	14	05	09	13	10	08	12	14	16	16	08	06	01	15	02	03
102	000	37984739	10	11	00	07	04	10	01	11	02.07	02	11	11	05	10	12	05	06	03	01	00	06	15	10	14	14	00	00	01	01	02	02
102	000	37986020	03	03	04	04	05	05	06	06	07.07	08	08	09	09	10	10	11	11	12	12	13	13	14	14	16	16	00	01	02	03	04	05
102	000	37987300	06	07	08	09	10	11	12	13	14.15	00	01	02	03	04	05	06	07	08	09	10	11	12	13	12	12	01	00	03	02	05	04
102	000	37988581	07	06	09	08	11	10	13	12	15.14	14	15	00	01	02	03	04	06	08	10	12	14	15	00	16	16	06	08	10	12	14	15
102	000	37989859	12	05	14	13	00	04	14	04	00.05	02	12	09	07	09	02	13	13	09	07	10	12	02	00	10	10	08	15	01	14	02	10
102	000	37991139	15	04	00	12	08	14	10	03	15.09	06	04	09	04	01	10	00	08	02	13	00	07	09	06	16	16	06	10	04	04	12	07
102	000	37992420	14	00	03	13	06	02	14	05	00.02	13	11	04	10	09	07	10	03	15	13	04	06	01	08	08	08	13	11	06	08	10	11
102	000	37993700	02	15	05	09	14	15	01	07	10.07	15	13	09	13	14	11	00	12	07	08	05	11	02	12	16	16	00	03	04	14	03	04
102	000	37994980	14	13	03	11	10	05	06	04	14.08	03	15	06	02	02	08	13	00	11	15	06	11	01	15	06	06	13	09	02	09	07	15
102	000	37996260	00	13	08	10	12	08	04	08	07.00	12	06	14	08	00	13	08	12	07	11	08	10	14	08	16	16	01	03	14	04	05	11
102	000	37997540	04	12	03	00	06	03	11	12	09.05	01	09	14	04	08	10	03	04	05	01	05	08	01	15	04	04	09	10	13	07	01	05
102	000	37998821	13	11	01	07	15	01	01	10	11.12	12	07	08	12	05	06	13	14	10	13	13	09	01	05	16	16	01	13	06	00	04	13
102	000	38000101	05	03	09	11	02	04	12	03	02.04	09	08	02	06	10	06	00	02	03	07	14	03	06	12	02	02	01	09	04	05	15	00
102	000	38001382	04	06	09	13	03	07	15	00	08.09	14	05	13	01	14	12	12	05	06	09	07	01	15	02	16	16	03	04	05	11	08	05
102	000	38002662	03	07	01	06	06	12	08	05	01.12	11	00	15	03	14	11	10	10	15	00	09	15	04	13	00	00	04	02	01	13	06	12
102	000	38003943	07	04	05	12	14	10	07	15	11.09	04	03	00	10	08	11	14	05	09	13	10	08	12	14	16	16	08	06	01	15	02	03
102	000	38005223	10	11	00	07	04	10	01	11	02.07	02	11	11	05	10	12	05	06	03	01	00	06	15	10	14	14	00	00	01	01	02	02
102	000	38006503	03	03	04	04	05	05	06	06	07.07	08	08	09	09	10	10	11	11	12	12	13	13	14	14	16	16	00	01	02	03	04	05
102	000	38007783	06	07	08	09	10	11	12	13	14.15	00	01	02	03	04	05	06	07	08	09	10	11	12	13	12	12	01	00	03	02	05	04
102	000	38009063	07	06	09	08	11	10	13	12	15.14	14	15	00	01	02	03	04	06	08	10	12	14	15	00	16	16	06	08	10	12	14	15
102	000	38010344	12	05	14	13	00	04	14	04	00.05	02	12	09	07	09	02	13	13	09	07	10	12	02	00	10	10	08	15	01	14	02	10
102	000	38011624	15	04	00	12	08	14	10	03	15.09	06	04	09	04	01	10	00	08	02	13	00	07	09	06	16	16	06	10	04	04	12	07
102	000	38012905	14	00	03	13	06	02	14	05	00.02	13	11	04	10	09	07	10	03	15	13	04	06	01	08	08	08	13	11	06	08	10	11
102	000	38014185	02	15	05	09	14	15	01	07	10.07	15	13	09	13	14	11	00	12	07	08	05	11	02	12	16	16	00	03	04	14	03	04
102	000	38015466	14	13	03	11	10	05	06	04	14.08	03	15	06	02	02	08	13	00	11	15	06	11	01	15	06	06	13	09	02	09	07	15
102	000	38016746	00	13	08	10	12	08	04	08	07.00	12	06	14	08	00	13	08	12	07	11	08	10	14	08	16	16	01	03	14	04	05	11
102	000	38018027	04	12	03	00	06	03	11	12	09.05	01	09	14	04	08	10	03	04	05	01	05	08	01	15	04	04	09	10	13	07	01	05
102	000	38019307	13	11	01	07	15	01	01	10	11.12	12	07	08	12	05	06	13	14	10	13	13	09	01	05	16	16	01	13	06	00	04	13
102	000	38020587	05	03	09	11	02	04	12	03	02.04	09	08	02	06	10	06	00	02	03	07	14	03	06	12	02	02	01	09	04	05	15	00

PERIOD INDICATES TIME AT WHICH TIME SAMPLE WAS TAKEN

DOUBLE NUMBER INDICATES FRAME AND SEQUENCE SYNC

Figure III-10 (Continued) Analog Direct 4 F Print — Part 2

DATA (w1, w2, w3, w4) (W2 AND w4 CONVERTEDTO VOLTS) (ANALOG)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14	16	16	08	06	01	15	02	03	10
w2	043	043	043	056	060	053	043	050	043	046	060	060	056	043	050	056	040	043	046	053	046	040	056	046	050	046	043	050	046	040	050	050
w3	00	00	00	00	00	08	00	14	00	00	00	03	00	10	00	00	00	05	00	00	00	14	00	14	00	10	00	05	00	08	00	00
w4	006	003	006	003	006	003	006	003	003	003	003	000	010	003	003	003	003	003	003	003	003	003	006	003	003	003	003	006	006	003	006	003

TF= 0102 DOY= 0000 MSEC=37063342

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	00	15	03	14	11	10	10	15	00	09	15	04	13	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04
w2	043	040	060	060	046	060	060	040	040	043	040	046	046	040	040	046	046	053	046	050	063	043	050	050	063	056	063	043	043	043	040	056
w3	10	14	00	03	00	11	00	12	13	00	00	00	00	01	13	00	00	00	00	08	00	11	00	09	00	12	00	10	00	00	00	00
w4	003	003	006	000	006	000	003	003	003	000	003	003	003	003	003	000	006	003	003	003	003	003	006	003	003	000	003	000	003	003	003	003

TF= 0102 DOY= 0000 SEW=3 0 83 7

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	07	08	08	09	09	10	10	11	11	12	12	13	13	14	15	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
w2	060	046	050	060	060	043	046	060	060	043	046	056	056	043	043	040	046	046	050	050	053	046	050	046	050	053	050	050	050	046	050	046
w3	00	00	00	00	00	09	00	10	00	11	00	12	00	00	00	00	00	16	00	00	00	03	00	00	00	00	00	15	00	14	00	00
w4	003	003	003	003	006	000	003	000	003	000	003	000	003	003	[illegible]	003	006	000	003	003	003	000	003	003	006	003	003	003	003	003	003	003

TF= 0102 DOY= 0000 MSEC=370863[illegible]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00	10	10	08	15	01	14	02	10	15	04	00	12	08	14
w2	053	043	046	060	043	050	056	056	056	043	043	046	060	060	043	046	043	060	043	046	043	046	046	043	050	040	046	056	060	043	043	043
w3	00	00	04	00	14	00	00	00	07	00	00	00	00	00	00	00	12	02	00	00	00	00	14	00	14	00	00	00	10	00	00	00
w4	003	003	000	006	003	006	003	006	000	003	003	003	003	006	003	006	000	000	006	006	003	003	003	006	003	006	003	003	003	006	003	006

TF= 0102 DOY= 0000 MSEC=37090155

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12	16	16	00	03	04	14	03	04	14	13	03
w2	046	046	056	053	043	060	046	053	043	043	043	053	043	053	060	050	050	063	040	046	060	043	043	060	046	053	063	040	056	063	046	040
w3	00	00	00	13	00	11	00	07	00	01	00	13	00	11	00	00	00	00	00	14	00	14	00	14	00	00	00	00	00	04	00	00
w4	003	003	003	003	006	003	006	000	003	003	003	000	003	000	003	003	003	003	003	003	003	003	003	003	006	003	003	003	003	000	003	003

TF= 0102 DOY= 0000 MSEC=37093970

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15	04	04	09	10	13	07	01	05	13
w2	046	053	056	046	053	043	046	043	063	043	043	046	046	050	[illegible]	053	050	060	043	060	046	043	063	050	050	046	056	050	063	043	050	046
w3	00	00	13	12	00	03	00	08	00	00	00	00	00	00	[illegible]	00	00	13	00	01	00	00	00	14	00	04	00	01	00	00	00	00
w4	003	003	003	003	006	000	003	003	003	003	003	003	003	003	[illegible]	003	003	003	006	000	006	003	003	003	006	000	003	003	003	003	003	003

TF= 0102 DOY= 0000 MSEC=37097812

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02	16	16	03	04	05	11
w2	046	056	043	053	050	053	050	046	043	053	060	043	060	060	050	043	056	046	046	060	046	040	046	046	046	060	046	050	043	046	060	053
w3	00	13	00	00	00	00	08	00	00	13	00	00	00	13	00	13	00	00	00	00	00	00	09	13	00	00	00	00	16	00	04	00
w4	003	003	000	006	003	003	003	006	003	003	003	006	003	006	[illegible]	003	003	006	003	003	003	006	000	003	003	003	003	003	000	003	000	006

TF= 0102 DOY= 0000 MSEC=37101653

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
w1	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10	14	14	00	00
w2	046	060	050	056	043	050	053	043	046	046	043	050	056	043	060	050	053	060	046	060	060	050	046	046	046	046	056	046	050	053	043	050
w3	06	00	10	00	00	00	08	00	07	00	10	00	11	00	07	00	11	00	00	00	00	00	11	00	01	00	14	00	12	00	10	00
w4	000	006	003	003	003	003	003	006	000	006	000	006	000	006	000	006	000	003	003	003	003	003	003	003	000	003	003	006	003	003	003	000

TF= 0102 DOY= 0000 MSEC=37105494

Figure III-10 (Continued). Analog Direct IMP-F Print - Sheet 3

SUBP

25052	DUMPAOPB	25533	BUFFPRNT	34727	TRIGSREV	35231	ANLGPRNT

ENTR

25477	LASTSS	25476	FIRSTSS	25052	START	25533	F9PRNT	35147	SINCOS	35015	AZIMUTH
35005	ARCCOS	34776	ARCSIN	34770	COSX	34730	SINX	35074	SQROOT	35231	BEGIN
31012	SEL	03376	UST	0.3436	CST	00060	CIT	03507	RHT	03447	AET
03650	ROCKSUM	03553	ROCKF1	00101	CIO	03721	START2	04220	LOADER	03527	ACCOUNTS,
03551	MEMORY	03263	ABNORMAL								

COMH

04454 04463

DATA

NONE

EXTA

NONE

Figure III-10 (Continued). Analog Direct IMP-F Print - Sheet 4

A. IDENTIFICATION

IF8BUPNT - COMPASS 32
R. W. NELSON, CODE 542, JANUARY 6, 1967
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

BUFFER TAPE PRINT ROUTINE FOR THE F-8 PROCESSING LINE. ROUTINE WILL OBTAIN DATA FROM F8 BUFFER TAPES AND PRINT O W ON LINE PRINTER CONTENTS OF THE TAPE. THE NUMBER OF FILES TO SKIP, RECORDS TO SKIP, AND RECORDS TO PRINT ARE INPUT FROM THE TYPE-WRITER *

C. USAGE

1. SPACE REQUIREMENTS - 2 BANKS
2. CONFIGURATION REQUIREMENTS - 1 SYSTEM TAPE, 1 F-8 BUFFER TAPE, CARD READER, LINE PRINTER.

D. OPERATING INSTRUCTIONS

1. EQUIP CARD IS USED TO DENOTE CHANNEL AND UNIT NUMBERS OF F-8 BUFFER TAPE. LOGICAL UNIT 12 IS USED IN THE ROUTINE FOR INPUT.

E. TECHNICAL NOTES

DO NOT USE CHANNEL 5 FOR INPUT. F8 BUFFER TAPE MAY BE MOUNTED AND EQUIPPEO ON ANY OTHER CHANNEL.

Figure III-11. F-8 Buffer Tape Print

A. IOENTIFICATIDN

F9 SEMI-AUTOMATIC DIAGNOSTIC (F9SAD)
L. H. RHODES , CODE 563
GODDARD SPACE FLIGHT CENTER

B. PURPOSE

DIAGNOSTIC ROUTINE FOR THE F9 PROCESSING LINE DEVELOPED BY THE PROCESSOR DEVELOPMENT BRANCH, INFORMATION PROCESSING DIVISION.

CALLS FOR DIGITAL VERSION (F9SAD,D.) AND ANALOG VERSION (F9SAD,A PROGRAMS WILL ACCEPT DATA FROM THE F9 LINE IN A KNOWN SEQUENCE .T

STANDARD DATA (SD) FORMAT AND COMPARE WITH THE STORED SD FORMAT . ERRORS ARE TABULATED AND DATA IS CLASSIFIED WITH A QUALITY CONTROL SUBROUTINE AND TABULATED UNDER THREE CLASSES OF GOOD, FAIR, AND POOR. AFTER A PREDETERMINED NUMBER OF SEQUENCES HAVE BEEN PROCESSED THE PROGRAM TERMINATES WITH A SUMMARY PRINT.

CALLS FOR DIGITAL VERSION (F9SAD,DT.) AND ANALOG VERSION F9SAD,AT.) PROGRAMS RECIEVE TIMES FROM F9 LINE AND PERFORMS A STATISTICAL DIFFERENCE TABLE ANALYSIS. WHEN A TIME OCCURS THAT EXCEEDS NORMALS THE TIME IS PRINTED ON THE LINE PRINTER WITH ITS DIFFERENCES.

C. USAGE

1. SPACE REQUIREMENTS - ^ BANKS
2. CONFIGURATION REQUIHEMENTS
   SYSTEM TAPE, CARD READER, LINE PRINTER, 1 MAG. TAPE AND F9 LINE .

D. OPERATING INSTRUCTIONS

1. SETUP F-9 LINE AND RESET.
2. LOAD PROGRAM WITH APPROPRIATE CALL.
   F9SAD,D. - OIGITAL DATA ANALYSIS PROGRAM
   F9SAD,A. - ANALOG DATA-ANALYS IS PROGRAM
   F9SAD,DT. - DIGITAL TIME ANALYSIS PROGRAM.
   F9SAD,AT. - ANALOG TIME ANALYSIS PROGRAM.
3. AT PROGRAM HALT, SELECT ANY OPTIONS DESIRED AND PUSH GO.
4. AFTER SUMMARY PRINTOUT OF DATA ANALYSIS PROGRAMS THE PROGRAM WILL HALT. TO REPEAT TEST JUST PUSH GO AGAIN.
   TIME ANALYSIS PROGRAMS WILL RUN UNTIL FORCE STOPPED.
5. OPTIONS FOR DATA ANALYSIS PROGRAMS
   AT PROGRAM INITIAL HALT 2 OPTIONS ARE AVAILABLE WITH THE STANDARD SETUP VALUES DISPLAYED IN REGISTER A AND Q.
   A= THE VALUE USED FOR AGC. Q= NUMBER OF SEQUENCES TO PROCESS.
   ALSO SEVERAL OPTIONS ARE AVAILABLE WITH JUMP SWITCHES.
   SJ2 DUMPS INFORMATION ON MAGNETIC TAPE ON LUN 1.
       LUN 1 MUST BE EQUIPPED BEFORE PROGRAM IS CALLED .
   SJ3 WILL PRINT AN ERROR SUMMARY AFTER EACH SEQUENCE.
   SJ5 WILL FREEZE THE AGC SETTING AT ITS PRESENT VALUE.
   SJ6 FORCES PROGRAM THRU FORMAT ERROR CONDITION.
6. OPTIONS FOR TIME ANALYSIS PROGRAMS
   SJ1 PRINTS EVERY TIME
7. PERTINENT REGISTERS
   REG 24 CONTAINS NUMBER OF SEQUENCES TO PROCESS (10).
   REG 64 CONTAINS THE PHASE LOCK VALUE CURRENTLY IN USE ON

   REG 65 CONTAINS THE AVERAGE W2 VALUE.
   REG 74 CONTAINS THE SEQUENCE NUMBER.
   REG 76 AND 77 CONTAINS W1,W2,W3,W4.

E. TECHNICAL NOTES

Figure III-12. F-9 Semi-Automatic Diagnostic

DIGITAL F9 SEMI-AUTOMATIC DIAGNOSTIC LINE IS GO TIME 1045 HOURS 04/07/67

NUMBER OF SEQUENCES ATTEMPTED TO PROCESS	+10		OPERATOR NAME..................................	
NUMBER OF SEQUENCES PROCESSED	+10		FRAME TIME DIFFERENCE EXCEEDED LIMITS COUNT	+0
TOTAL ERRORS AND RATE	+56	1.09%	LAST FRAME DIFFERENCE IN MILLISECONDS	+1427

SEQUENCE STANDARD RERERENCE DATA

CHANNEL

FRAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
2	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
3	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
4	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
5	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	09	02	13	00	07	09	06
6	16	16	06	10	04	04	12	07	14	00	03	13	08	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
7	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
8	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
9	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
10	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
11	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
12	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	08	02	03	07	14	03	06	12
13	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
14	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
15	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
16	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10

DATA ERROR DISTRIBUIION TABLE

CORRELLATOR ↓ →	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTALS
+0	[illegible]	[illegible]	[illegible]	+0	[illegible]	+0	+0	[illegible]	+1	[illegible]	+0	+0	[illegible]	[illegible]	+0	+0	+0	+1
+1	+1	+0	+0	+0	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+0	+0	+0	+2
+2	+0	+2	+0	+0	+0	+0	+0	+0	+0	+2	+0	+0	+0	+0	+0	+0	+0	+4
+3	+0	+0	+0	+0	+0	+0	+0	+0	+0	+2	+0	+0	+0	+0	+0	+0	+0	+2
+4	+0	+0	+4	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+4
+5	+0	+0	+1	+0	+0	+0	+0	+0	+0	+0	+2	+0	+0	+0	+0	+0	+0	+3
+6	+0	+0	+0	+3	+0	+0	+0	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+4
+7	+0	+0	+0	+4	+0	+0	+0	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+5
+8	+0	+0	+0	+0	+3	+0	+0	+0	+0	+0	+0	+0	+2	+0	+0	+0	+0	+5
+9	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+0	+0	+2	+0	+0	+0	+0	+3
10	+0	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+0	+0	+4	+0	+0	+0	+5
11	+0	+0	+0	+0	+0	+5	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+5
12	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+3	+0	+0	+3
13	+0	+0	+0	+0	+0	+0	+3	+0	+0	+0	+0	+0	+0	+0	+3	+0	+0	+6
14	+0	+0	+0	+0	+0	+0	+0	+1	+0	+0	+0	+0	+0	+0	+0	+3	+0	+4
15	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
16	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	

+0 DAYS	+0 HOURS	12 MIN	38 SEC	TIME PHASE SYNC ACQUIRED		+1	SEQ SYNC ACQUIRED	+0	PHASE SYNC LOST
+0 DAYS	+0 HOURS	+0 MIN	+0 SEC	TIME PHASE SYNC LOST	+5120	100.00%GOOD	+0 0.00%FAIL	+0	0.00%POOR

PERCENT	TOTAL SEQUENCES	
0.00%	+0	ONE ERROR IN 100 OR MORE
0.00%	+0	ONE ERROR IN 330
0.00%	+0	ONE ERROR IN 500
100.00%	+10	ONE ERROR IN 1000 OR LESS

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 2

```
+1 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
             +512  SAMPLES      +13 XBAR  +0 SIG8340.50 L     +512 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+2 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
       [illegible] [illegible]  [illegible]                  +1024 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+3 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +1536  SAMPLES      +12 XBAR +11 SIG +11.03 L    +1536 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+4 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2048  SAMPLES      +12 XBAR +12 SIG +10.13 L    +2048 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+5 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2560  SAMPLES      +12 XBAR +11 SIG +10.85 L    +2560 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+6 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3072  SAMPLES      +12 XBAR  +8 SIG +15.52 L    +3072 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+7 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3584  SAMPLES      +12 XBAR  +7 SIG +15.95 L    +3584 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+8 SEQ  +0 PSL     +0 ERRORS    0.00%                  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
      [illegible]  SAMPLES      +13 XBAR  +0 SIG8351.00 L    +4096 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+9 SEQ  +0 PSL    +56 ERRORS    1.21%                  +1  +2  +4  +2  +4  +3  +4  [illegible]
            +4608  SAMPLES      +10 XBAR +19 SIG  +5.50 L    +4608 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR

+10 SEQ +0 PSL    +56 ERRORS    1.09%                  +1  +2  +4  +2  +4  +3  +4  +5  +5  +3  +5  +5  +3  +6  +4  +0  +0
            +5120  SAMPLES      +14 XBAR +16 SIG  +8.91 L    +5120 100.00%GOOD     +0   0.00%FAIR       +0   0.00%POOR
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic – Sheet 3

DIGITAL F9 SEMI-AUTOMATIC DIAGNOSTIC   LINE IS 80   TIME 1045 HOURS 04/07/67

NUMBER OF SEQUENCES ATTEMPTED TO PROCESS +10
NUMBER OF SEQUENCES PROCESSED +10
TOTAL ERRORS AND RATE +0 0.00%

OPERATOR NAME..................................
FRAME TIME DIFFERENCE EXCEEDED LIMITS COUNT +0
LAST FRAME DIFFERENCE IN MILLISECONDS +1427

SEQUENCE STANDARD RERERENCE DATA

CHANNEL

FRAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06
2	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13
3	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12
4	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04
5	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03
6	16	16	06	10	04	04	12	07	14	00	03	13	06	02	14	05
7	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07
8	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04
9	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08
10	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12
11	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10
12	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03
13	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00
14	16	16	03	04	05	11	08	05	03	07	01	06	05	12	08	05
15	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15
16	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11

FRAME	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
2	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
3	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
4	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
5	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
6	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
7	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
8	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
9	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
10	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
11	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
12	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
13	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
14	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
16	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10

DATA ERROR DISTRIBUTION TABLE

CORRELLATOR ↓ →	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTALS
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+1	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+2	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+3	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+4	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+5	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+6	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+7	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+8	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+9	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
10	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
11	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
12	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
13	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
14	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
15	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
16	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	

SYSTEMATIC ERRORS (W1=W3) NUMBER OF INSTANCES PER CORRELATOR

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

+0 DAYS +0 HOURS 17 MIN 36 SEC TIME PHASE SYNC ACQUIRED +1 SEQ SYNC ACQUIRED +0 PHASE SYNC LOST
+0 DAYS +0 HOURS +0 MIN +0 SEC TIME PHASE SYNC LOST +5120 100.00%GOOD +0 0.00%FAIR +0 0.00%POOR

PERCENT	TOTAL SEQUENCES	
0.00%	+0	ONE ERROR IN 100 OR MORE
0.00%	+0	ONE ERROR IN 330
0.00%	+0	ONE ERROR IN 500
100.00%	+10	ONE ERROR IN 1000 OR LESS

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic – Sheet 4

```
+1 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
             +512  SAMPLES       +18 XBAR +16 SIG +11.16 L    +512 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+2 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +1024  SAMPLES       +19 XBAR +13 SIG +14.54 L   +1024 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+3 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +1536  SAMPLES       +18 XBAR +14 SIG +13.01 L   +1536 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+4 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2048  SAMPLES       +18 XBAR +16 SIG +11.02 L   +2048 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+5 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2560  SAMPLES       +19 XBAR +12 SIG +15.46 L   +2560 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+6 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3072  SAMPLES       +18 XBAR +13 SIG +14.04 L   +3072 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+7 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3584  SAMPLES       +18 XBAR +11 SIG +17.14 L   +3584 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+8 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +4096  SAMPLES       +18 XBAR +14 SIG +13.24 L   +4096 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+9 SEQ  +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +4608  SAMPLES       +18 XBAR +14 SIG +12.78 L   +4608 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
+10 SEQ +0 PSL      +0 ERRORS   0.00%              +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +5120  SAMPLES       +18 XBAR +12 SIG +14.47 L   +5120 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 5

DIGITAL TIME ANALYSIS PROGRAM

DAYS	HOURS	MIN	SEC	MS	DIFF: 1ST	2ND	SAMPLES BETWEEN TIMES
+0	+0	+5	+3	+827	+0	+0	+5279913
+0	+0	+5	+4	+655	+1428	+1428	+31
+0	+0	+5	+6	+83	+1428	+0	+31
+0	+0	+5	+7	+511	+1428	+0	+31
+0	+0	+5	+8	+939	+1428	+0	+31
+0	+0	+5	10	+367	+1428	+0	+31
+0	+0	+5	11	+794	+1427	-1	+31
+0	+0	+5	13	+222	+1428	+1	+31
+0	+0	+5	14	+650	+1428	+0	+31
+0	+0	+5	16	+78	+1428	+0	+31
+0	+0	+5	17	+506	+1428	+0	+31

Figure III-12 (Continu< ⊇9 Semi-Automatic Diagnostic – Sheet 6

```
SUBP
 25344  TRIGSREV     31276  DIMPFOLP

ENTR
 25564  SINCOS       25432  AZIMUTH      25422  ARCCOS       25413  ARCSIN      2545  OSX         5345  SINX
 25511  SQROOT       31276  DIMPFOLP     01012  SEL          03376  UST         0345  ST          0060  CIT
 03507  RHT          03447  AET          03650  RDCKSUM      03553  RDCKF1      0017  CO          8721  START2
 04220  LOADER       03527  ACCOUNTS     03551  MEMORY       03263  ABNORMAL

COMM
 04454    25135

DATA
 25646

EXTA
     NONE
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 7

ANALOG F9 SEMI-AUTOMATIC DIAGNOSTIC   LINE 18 80   TIME 1050 HOURS 04/07/67

NUMBER OF SEQUENCES ATTEMPTED TO PROCESS	+10	OPERATOR NAME....................................	
NUMBER OF SEQUENCES PROCESSED	+10	FRAME TIME DIFFERENCE EXCEEDED LIMITS COUNT	+0
TOTAL ERRORS AND RATE	+0 0.00%	LAST FRAME DIFFERENCE IN MILLISECONDS	+1427

SEQUENCE STANDARD RERERENCE DATA

CHANNEL

FRAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
2	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
3	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	05	08	10	12	14	15	00
4	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
5	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
6	16	16	06	10	04	04	12	07	14	00	03	13	08	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
7	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
8	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
9	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
10	16	16	01	03	14	04	05	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
11	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
12	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
13	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
14	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
15	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
16	16	16	08	06	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10

DATA ERROR DISTRIBUTION TABLE

CORRELATOR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTALS
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+1	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+2	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+3	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+4	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+5	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+6	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+7	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+8	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+9	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
10	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
11	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
12	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
13	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
14	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
15	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
16	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

SYSTEMATIC ERRORS (W1=W3) NUMBER OF INSTANCES PER CORRELATOR

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16
+0	+0	+0	+0	+0	+0	+0	+0	+0	0+n	0+n	0+n	0+0	0+0	0+0	0

+0 DAYS	+0 HOURS	38 MIN	44 SEC	TIME PHASE SYNC ACQUIRED		+1	SEQ SYNC ACQUIRED			+0	PHASE SYNC LOST		
+0 DAYS	+0 HOURS	+0 MIN	+0 SEC	TIME PHASE SYNC LOST	+5120	100.00%GOOD		+0	0.00%FAIL	+0	0.00%POOR		

PERCENT	TOTAL SEQUENCES	
20.00%	+2	ONE ERROR IN 100 OR MORE
80.00%	+8	ONE ERROR IN 330
0.00%	+0	ONE ERROR IN 500
0.00%	+0	ONE ERROR IN 1000 OR LESS

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 8

```
+1 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
                +512  SAMPLES      +13 XBAR +32 SIG  +4.24 L     +512 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+2 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +1024  SAMPLES      +13 XBAR +33 SIG  +4.09 L    +1024 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+3 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +1536  SAMPLES      +13 XBAR +32 SIG  +4.25 L    +1536 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+4 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +2048  SAMPLES      +14 XBAR +33 SIG  +4.16 L    +2048 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+5 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +2560  SAMPLES      +13 XBAR +33 SIG  +4.02 L    +2560 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+6 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +3072  SAMPLES      +13 XBAR +33 SIG  +4.16 L    +3072 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+7 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +3584  SAMPLES      +13 XBAR +33 SIG  +4.08 L    +3584 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+8 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +4096  SAMPLES      +13 XBAR +34 SIG  +3.94 L    +4096 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+9 SEQ  +0 PSL      +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +4608  SAMPLES      +14 XBAR +36 SIG  +3.89 L    +4608 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR

+10 SEQ  +0 PSL     +0 ERRORS   0.00%                    +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
               +5120  SAMPLES      +14 XBAR +35 SIG  +4.03 L    +5120 100.00%GOOD      +0    0.00%FAIR       +0    0.00%POOR
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 9

ANALOG F9 SEMI-AUTOMATIC DIAGNOSTIC LINE 18 00 TIME 1050 HOURS 04/07/67

NUMBER OF SEQUENCES ATTEMPTED TO PROCESS	+10		OPERATOR NAME..................................	
NUMBER OF SEQUENCES PROCESSED	+10		FRAME TIME DIFFERENCE EXCEEDED LIMITS COUNT	+0
TOTAL ERRORS AND RATE	+0	0.00%	LAST FRAME DIFFERENCE IN MILLISECONDS	+1425

SEQUENCE STANDARD RERERENCE DATA

CHANNEL

FRAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	14	14	00	00	01	01	02	02	03	03	04	04	05	05	06	06	07	07	08	08	09	09	10	10	11	11	12	12	13	13	14	14
2	16	16	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	00	01	02	03	04	05	06	07	08	09	10	11	12	13
3	12	12	01	00	03	02	05	04	07	06	09	08	11	10	13	12	15	14	14	15	00	01	02	03	04	06	08	10	12	14	15	00
4	16	16	06	08	10	12	14	15	12	05	14	13	00	04	14	04	00	05	02	12	09	07	09	02	13	13	09	07	10	12	02	00
5	10	10	08	15	01	14	02	10	15	04	00	12	08	14	10	03	15	09	06	04	09	04	01	10	00	08	02	13	00	07	09	06
6	16	16	06	10	04	04	12	07	14	00	03	13	06	02	14	05	00	02	13	11	04	10	09	07	10	03	15	13	04	06	01	08
7	08	08	13	11	06	08	10	11	02	15	05	09	14	15	01	07	10	07	15	13	09	13	14	11	00	12	07	08	05	11	02	12
8	16	16	00	03	04	14	03	04	14	13	03	11	10	05	06	04	14	08	03	15	06	02	02	08	13	00	11	15	06	11	01	15
9	06	06	13	09	02	09	07	15	00	13	08	10	12	08	04	08	07	00	12	06	14	08	00	13	08	12	07	11	08	10	14	08
10	16	16	01	03	14	04	09	11	04	12	03	00	06	03	11	12	09	05	01	09	14	04	08	10	03	04	05	01	05	08	01	15
11	04	04	09	10	13	07	01	05	13	11	01	07	15	01	01	10	11	12	12	07	08	12	05	06	13	14	10	13	13	09	01	05
12	16	16	01	13	06	00	04	13	05	03	09	11	02	04	12	03	02	04	09	08	02	06	10	06	00	02	03	07	14	03	06	12
13	02	02	01	09	04	05	15	00	04	06	09	13	03	07	15	00	08	09	14	05	13	01	14	12	12	05	06	09	07	01	15	02
14	16	16	03	04	05	11	08	05	03	07	01	06	06	12	08	05	01	12	11	00	15	03	14	11	10	10	15	00	09	15	04	13
15	00	00	04	02	01	13	06	12	07	04	05	12	14	10	07	15	11	09	04	03	00	10	08	11	14	05	09	13	10	08	12	14
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01	15	02	03	10	11	00	07	04	10	01	11	02	07	02	11	11	05	10	12	05	06	03	01	00	06	15	10

DATA ERROR DISTRIBUTION TABLE

JR + +	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTALS
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+1	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+2	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+3	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+4	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+5	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+6	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+7	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+8	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
+9	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
10	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
11	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
12	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
13	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
14	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
15	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0
16	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

SYSTEMATIC ERRORS (W1=W3) NUMBER OF INSTANCES PER CORRELATOR

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0

+0 DAYS	+0 HOURS	43 MIN	41 SEC	TIME PHASE SYNC ACQUIRED		+1	SEQ SYNC ACQUIRED	+0	PHASE SYNC LOST
+0 DAYS	+0 HOURS	+0 MIN	+0 SEC	TIME PHASE SYNC LOST	+5120 100.00%GOOD	+0	0.00%FAIR	+0	0.00%POOR

PERCENT	TOTAL SEQUENCES	
80.00%	+8	ONE ERROR IN 100 OR MORE
20.00%	+2	ONE ERROR IN 350
0.00%	+0	ONE ERROR IN 500
0.00%	+0	ONE ERROR IN 1000 OR LESS

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic Sheet 10

a

```
+1 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
             +512   SAMPLES      +14 XBAR +36 SIG  +3.83 L      +512 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+2 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +1024   SAMPLES      +14 XBAR +37 SIG  +3.94 L     +1024 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+3 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +1536   SAMPLES      +14 XBAR +36 SIG  +3.93 L     +1536 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+4 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2048   SAMPLES      +13 XBAR +39 SIG  +3.90 L     +2048 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+5 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +2560   SAMPLES      +14 XBAR +34 SIG  +4.08 L     +2560 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+6 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3072   SAMPLES      +14 XBAR +35 SIG  +4.00 L     +3072 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+7 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +3584   SAMPLES      +13 XBAR +32 SIG  +4.17 L     +3584 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+8 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +4096   SAMPLES      +14 XBAR +37 SIG  +3.93 L     +4096 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+9 SEQ  +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +4608   SAMPLES      +14 XBAR +35 SIG  +3.97 L     +4608 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR

+10 SEQ +0 PSL      +0 ERRORS    0.00%                 +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0  +0
            +5120   SAMPLES      +14 XBAR +35 SIG  +3.99 L     +5120 100.00%GOOD   +0   0.00%FAIR     +0   0.00%POOR
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic – Sheet 11

DAYS	HOURS	MIN	SEC	MS	DIFF! 1ST	2ND	SAMPLES BETWEEN TIMES
+0	+3	+6	+1	+311	+0	+0	+231489
+0	+3	+6	+2	+739	+1428	+1428	+31
+0	+3	+6	+4	+168	+1429	+1	+31
+0	+3	+6	+5	+596	+1428	-1	+31
+0	+3	+6	+7	+24	+1428	+0	+31
+0	+3	+6	+8	+452	+1428	+0	+31
+0	+3	+6	+9	+880	+1428	+0	+31
+0	+3	+6	11	+308	+1428	+0	+31
+0	+3	+6	12	+736	+1428	+0	+31
+0	+3	+6	14	+164	+1428	+0	+31
+0	+3	+6	15	+593	+1429	+1	+31

ANALOG TIME ANALYSIS PROGRAM

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic - Sheet 12

```
SUMP
 26222  TRIGSREV      32161  AIMPFOLP

ENTR
 26442  SINCOS        26310  AZIMUTH     26300  ARCCOS      26271  ARCSIN      26263  COSX        26223  SINX
 26367  SQROOT        32161  AIMPFOLP    01012  SEL         03376  UST         03436  CST         00060  CIT
 03507  RHT           03447  AET         03650  RDCKSUM     03553  RDCKF1      00107  CIO         03721  START2
 04220  LOADER        03527  ACCOUNTS    03551  MEMORY      03263  ABNORMAL

COMM
 04454   25135

DATA
 26524

EXTA
     NONE
```

Figure III-12 (Continued). F-9 Semi-Automatic Diagnostic – Sheet 13

```
A. IDENTIFICATION
       FILE MANAGEMENT PROGRAM ( F9FILMGT )
       L. H. HHOOES , CODE 563
       GODDARD SPACE FLIGHT CENTER
       PROCESSOR DEVELOPMENT BRANCH, INFORMATION PROCESSING DIVISION.

B. PURPOSE
       PROGRAM ENABLES AN ANALYST TO MANIPULATE FILES FROM UP TU THREE INPUT
       TAPES TU PRODUCE AN OUTPUT TAPE THAT WILL BE CORRECT FOR SUBMISSION
       TO A DESIRED FOLLOWING PROGRAM.  THE ANALYST MAY ALSO CALL FOR
       QUALITY INFORMATION TO BE PLOTTED OH LISTED FROM THE INPUT TAPES.

C. USAGE
       1. SPACE REQUIREMENTS - 2 BANKS
       2. CONFIGURATION HEQUIHEMENTS -
          SYSTEM TAPE, CARD READER, LINE PRINTER,  AND 4 MAG TAPES

D. OPERATING INSTRUCTIONS
       1. EOUIP MAG TAPES ON LUN 1,2,3 AND LUN 9.
       2. LOAD PROGRAM WITH A CALL FOR F9FILMGT
       3. PLACE TASK CAHUS IN CARD READER.

E. TECHNICAL NOTES

       EACH TASK IS CALLED FOR BY A PUNCHED CARD ( TASK CAHO ).
       ALL CALLS BEGIN IN COLUMN 1
       TYPES OF CARDS OH TASKS ALLOWED.

          FILEDESC,X,BIN,   RECORD SIZE  ,  ID LENGTH  ,  ID LOCATION
                    ,BIN,   INOICATES  BINAHY RECORDS.
                    ,BCD,   INUICATES BCD RECORDS.
                            THE FILEDESC CARD IS NECESSARY TO DESCRIBE THE
                            TYPES OF FILES BEING OPERATED UPON OH ASSOCIATED
                            WITH A PARTICULAR LUN. THEY MUST PRECEDE ANY
                            TASK CALLS FOR THAT PARTICULAR LUN.

          SKIPFILE,X,N=     SKIPS NUMBER OF FILES INDICATED.
                    ,ID=    SKIPS TO FILE WITH ID EQUAL TO INDICATED STRING.

          COPYFILE,X,N=     COPIES NUMBER OF FILES INDICATED.
                    ,ID=    COPIES TO FILE WITH ID EQUAL TO INDICATED STRING.

          REWIND,X          REWINDS LUN X
          UNLOAD,X          UNLOADS LUN X
          WREOF             WRITES END OF FILE MAHK ON LUN 9
          ENDJOB            WRITES 2 END OF FILES ON LUN 9  AND REWINDS.

          VERIFYMT,X,N=     VEFIFIES NUMBER OF FILES INDICATED.
                    ,ID=    VERIFIES TO FILE WITH IO EQUAL TO INDICATED STRING.
                            ( VERIFICATION IS BETWEEN LUN X AND LUN 9. )

          QUALPLOT,X,Z,N=   PLOTS NUMBER OF FILES INDICATED ACCORDING TO
                            OPTION CALLED FOH BY Z CODE.
                      Z =  0  LISTS SEQUENCE SUMMARY INFORMATION WITH
                              SEQUENCES BEING COMPRESSED THAT HAVE 100.00  %
                           -  OF GOOD COMBINED WITH FAIR.
                           1  PLOTS ALL DATA SEQUENCES.
                           2  PLOTS ONLY FILE TOTALS.
                           4  PRINTS ONLY FILE TOTALS.
                           6  PLOTS AND PRINTS ONLY FILE TOTALS.
```

Figure III-13. File Management Program Print

SYMBOLS USED BY TASK CARD DESCRIPTIONS.

X — LUN NUMBER OF A MAG TAPE.
LUN 1,2,3 ARE INPUT TAPES AND LUN 9 IS THE OUTPUT TAPE.

N= — FOLLOWED BY A NUMBER IS THE NUMBER OF FILES THAT WILL BE OPERATED UPON-

ID= — FOLLOWED BY A CHARACTER STRING WILL BE THE ID OF A PARTICULAR FILE BEING REFERENCED.
BIN WILL OPERATE ON 3 BIT CHARACTER STRINGS.
BCD WILL OPERATE ON 6 BIT CHAHACTEH STRINGS.

BCD OR BIN ALSO INOICATES THE PARITY OF CHARACTERS IN THE RECORDS.

Z — OPTION CODE USED FOR QUALITY PLOT TASK.

Figure III-13 (Continued). File Management Program Print

The following is a list of functions performed by this program:

1. Compare the I. D. information from the tape-log card with the I. D. from the buffer tape to ensure that the tapes are being processed in the correct order. The normal processing groups will be one orbit of data. This may involve as many as sixty analog station tapes and possibly as many digital F-8 buffer tapes. But, the intent is to have multiple-file buffer tapes so that, in general, some number less than ten F-8 buffer tapes will make up one orbit's data group. Checks of the I. D. record vs the parameter card will be made to make sure that the operator has mounted the proper tape.

2. Check for parity errors on writing the intermediate tape. Make sure that the output tape is free of parity errors.

3. Compute DELTA T, the frame time difference, for each successive frame. Flag those DELTA T's which are outside tolerance and put DELTA T in the appropriate location on the intermediate tape.

4. Compute the total frames expected, also the sequence and samples, from the first frame time until the last frame time in the file for each file. Sum the total number of frames, samples, and sequences actually processed. These totals and the computed percentages are displayed on the Data Quality Summary printout.

5. Establish frame and sequence sync, and maintain sync with the sequences on the intermediate tape.

6. Produce a summary printout for each F-8 buffer tape file to be analyzed by Quality Control personnel to determine the data quality of each tape.

7. F-8 Buffer tape characters -

1 2	4	8	S.O	O	P

P = horizontal parity track bit

S. O = synchronizer oscillator bit

1,2,4,8 = 2^0, 2^1, 2^2, 2^3 bits

Check when the S.O. bit should be present. If the S.O. is true, then the hex bits in the 1,2,4,8 bits should not be true. This condition should not occur very often, but it is possible. If it does come up, flag with a note to the operator and terminate processing this file.

8. Provide for partial sequence processing.

3.10.2 Process Partial Sequences

1. Check the least significant burst of the sequence clock (satellite clock):

   a. Compare to see if it is advancing sequentially. Use the frame times to insure that there are no missing sequences.

   b. Check for agreement between the Frame 7 and Frame 15 values. Count the errors.

2. Check for sync word (Channel 0) and frame count (Channel 0). Count the errors.

3. Check for total data recovery. Find the number of data points in each category.

3.10.3 Quality Control Printout

1. Find sequence lock (sync).

2. Count number of Channel 0 values examined.

3. Count number of Channel 0 errors examined.

4. Print percent of errors.

5. Count number of LSB satellite clock bursts examined.

6. Count errors.

7. Print percent of errors.

8. Check millisecond clock for "time outside tolerance".

9. Do not process if number of characters per record is wrong. Flag and halt.

10. Do not process if the number of data samples between time words is wrong. Flag and halt.

11. Do not process if the I.D. is wrong. Make provision for bypassing this halt in case a buffer tape with the wrong I.D. record is received.

12. The number of times a "loss of sync flag" occurred during a file is to be printed in the Q. C. listing.

13. The data flag in the F-8 buffer format, if set to 1, indicates that the line was not able to assign the incoming frequency to any one of the numbers between 0 through 16 (equivalent to no data).

3.10.4 Data Quality Flag Assignment

One of four data-quality indicators (flags) will be assigned to each data-sample processed and written on the intermediate data tapes by the F-8 Buffer Mode Program. These flags are similar to the quality flags assigned in the F-9 On-Line Processor Program, but the method of assignment is different. In each 12-bit sample byte on the intermediate data tape, the quality flags are positioned in the following format:

11		9			6	5					0
		LSF			Q	F	C	C	C	C	C

where:

CCCC = correlator number

QF = data-quality flag

LSF = loss of phase-sync flag

The four data-quality flags and their values are:

11 = good data

10 = fair data

01 = poor data

00 = undetermined data quality

If less than a complete telemetry sequence is available, no evaluation of the data quality is made and the assignment for all samples in the partial sequence is "undetermined".

The basis for assigning the quality-indicator is the total errors found in the sequence within the following three categories: **(1)** Satellite Clock, **(2)** Channel Zero, and **(3)** no data.

1. The least significant burst of the satellite clock (Frames **7** and **15,** Channels **14** and **15)** in each sequence is examined and an error scored if -

   a. Frame **7** and Frame 15 are not identical.

   b. The satellite clock is not advancing monotonically, MOD 8.

2. Channel zero of each frame in the sequence is checked. In each case that it is not identical with the value it should be, an error is scored.

3. Each of the no-data flags (004,) is scored as an error. These no-data samples occur during F-8 digitizing when the correct frequency cannot be assigned for a particular sample.

The sum of the errors of type **(1), (2),** and **(3)** then determine the flag assignment for all samples in the sequence.

If the total errors $\leq$ **1,** the quality flag is good
If the total errors >1 $\leq$ **3,** the quality flag is fair
If the total errors >3 **,** the quality flag is poor

3.10.5 F-8 Buffer Tape Format

The F-8 Buffer Tapes are written in binary (odd-bit parity). The digitized data from one analog tape is written as one file. There may be several files of data on one digital tape. One end-of-file mark separates the data files.

The first record in each data file is an identification record. All records in the file, including the I.D. record, are **2368** characters in length. Only the first 18 characters of the I.D. record are unique characters; the remainder of the record is filled by repeating the first 18 characters.

The characters which make up the I.D. record are in standard binary-coded-decimal code, except that the parity bit is added for odd parity.

Following the last data file is a one-record file end of tape sentinel. This entire record contains BCD 9's. Two end-of-file marks (EOF) successively may be used to initiate end-of-tape.

In case of loss of sync, the remainder of the record will be completed with fill characters. If loss of sync continues longer than one sequence, however, the buffer will wait until sync is re-established so that there will be no complete records full of fill characters.

F-8 BUFFER TAPE FORMAT (FRAME FORMAT)

	1	2	4	8	A	B	P	
Time Word	TF	TF	TF	TF	TF	1	X	← First Character on Each Record
	Y^6	Y7	Y^8	TF	TF	TF	X	
	Y^1	Y^2	Y^3	Y^4	Y^5	1	X	
	M^{22}	M^{23}	M^2	M^{25}	M^{26}	Y^0	X	
	M^1	M^{18}	M^1	M^{20}	M^2	1	X	
	M^1	M^{12}	M^{13}	M^{14}	M^1	M^{16}	X	
	M^6	M^7	M^8	M^9	M^{10}	1	X	
	M^0	M^1	M^2	M^3	M^4	M^5	X	
	0	0	0	0	0	0	X	
	0	0	0	0	0	0	X	
	0	0	0	0	0	0	X	
	0	0	0	0	0	0	X	
Channel 0	0	0	0	0	1	0	0	
	0	0	DF	0	0	0	X	
Channel 1A	X	X	X	X	X	0	X	
	X	X	DF	X	X	0		
Channel 1B	X	X	X	X	X	0	X	
	X	X	DF	X	X	0	X	
Channel 15A	X	X	X	X	X	O	X	
	X	X	DF	X	X	O	X	
Channel 15B	X	X	X	X	X	O		
	X	X	DF	X	X	O		

Data -

One Frame = 62 Characters

16 of These Frames Per Record (2368 Characters Per Record)

3.11 ANALOG TAPE I. D. CARD FORMAT

COLUMN	IDENTIFICATION	
1-4	Satellite I. D.	
5-7	Station I. D.	
8	Unused	
9-12	Analog Tape Number	
13	Year	Date of Recording
14-15	Month	
16-17	Day	
18-22	Buffer Tape Number (Set to zero if processing on-line).	
23-26	Orbit (pass) Number	
27-30	Unused	
31-32	File Number	
33	Unused	
34-35	Hour	Analog Tape Start Time
36-37	Minute	
38-39	Second	
40	Unused	
41-42	Hour	Analog Tape Stop Time
43-44	Minute	
45-46	Second	
47	Unused	
48	Year	Date Tape Received
49-50	Month	
51-52	Day	
53-55	Tape Evaluation Code	
56-57	Year	Date Tape Evaluated
58-59	Month	
60-61	Day	
62	Analog-to-Digital Line I. D.	

Note: The analog-to-digital line specification code is:

1 = F-9
2 = F-8

3.12 IMP-F INTERMEDIATE DATA TAPE I.D. RECORD

WORD NO.	IDENTIFICATION	
1	Satellite I.D.	
2	Station I.D.	
3	Analog Tape Number	
4	Year	Date of Recording
5	Month	
6	Day	
7	Buffer Tape Number (Set to zero if processing on-line)	
8	Orbit (pass) Number	
9	File Number	
10	Hour	Analog Tape Start Time
11	Minute	
12	Second	
13	Hour	Analog Tape Stop Time
14	Minute	
15	Second	
16	Year	Date Tape Received
17	Month	
18	Day	
19	Evaluation Code	
20	Year	Date Tape Was Evaluated
21	Month	
22	Day	
23	Analog-to-Digital Line I.D.	
24	Tape Continuation Number	
25-320	Fill words made up of words 1-23 repeated	
321	313131318 - This is a record-identifier word which distinguishes this record from the data records and the data summary records.	

Note: Each word is 24 bits. Each item is right-adjusted integer form. The record is written in binary-mode.

3.13 INTERMEDIATE TAPE FORMAT FOR DATA RECORDS (Consists of 321 24–bit Words)

Word 1	W1	W2	Frame Time Sample	
Word 2	W3	W4	Frame Time Sample	
Word 3	TF	ΔT	Frame Time Difference	
	19,18,17→0			
Word 4	FN	CN		
Word 5	W1	W1		
Word 6	W1	W1		3,4
Word 7	W1	W1		5,6
Word 8	W1	W1		7,8
Word 9	W1	W1		9,10
Word 10	W1	W1		11,12
Word 11	W1	W1		13,14
Word 12	W1	W1		15,16
Word 13	W1	W1		17,18
Word 14	W1	W1		19,20
Word 15	W1	W1		21,22
Word 16	W1	W1		23,24
Word 17	W1	W1		25,26
Word 18	W1	W1		27,28
Word 19	W1	W1		29,30
Word 20	W1	W1		31,32

1 FRAME OF DATA

2 FRAMES

SAME FORMAT PER FRAME

16 FRAMES

25252525 SIGNALS END OF DATA RECORD

3.14 INTERMEDIATE DATA TAPE FILE SUMMARY RECORD FORMAT

<u>Note</u>: Each value is in a 24-bit, fixed point, right-adjusted byte (word).

VALUE	NUMBER OF WORDS
Intermediate Tape File Number	1
Analog Tape Number	1
Analog Tape Start Time	2
Analog Tape Stop Time	2
Station Number	1
Orbit Number	1
Total Samples Recovered	1
Total Samples Good	1
Total Samples Fair	1
Total Samples Bad	1
Total Samples Undetermined (unused)	1
Percent Good Samples	1
Percent Fair Samples	1
Percent Bad Samples	1
Percent Undetermined Samples (unused)	1
Total Frames Recovered	1
Total Frames Expected	1
Percent Frames Recovered	1
Number of Sequences P. E. $\leq 1 \times 10^{-4}$	1
Number of Sequences P. E. ■ 5×10^{-4}	1
Number of Sequences P. E. $\leq 1 \times 10^{-3}$	1
Number of Sequences P. E. ■ 5×10^{-3}	1
Number of Sequences P. E. $\leq 1 \times 10^{-2}$	1
Number of Sequences P. E. ■ 5×10^{-2}	1
Number of Sequences P. E. ■ 1×10^{-1}	1

VALUE	NUMBER OF WORDS
Number of Sequences P. E. 5 5 X 10^{-1}	1
Percent of Sequences P. E. ≤ 1 X 10^{-4}	1
Percent of Sequences P. E. ≤ 5 X 10^{-4}	1
Percent of Sequences P. E. ≤ 1 X 10^{-3}	1
Percent of Sequences P. E. ≤ 5 X 10^{-3}	1
Percent of Sequences P. E. ≤ 1 X 10^{-2}	1
Percent of Sequences P. E. ≤ 5 X 10^{-2}	1
Percent of Sequences P. E. ≤ 1 X 10^{-1}	1
Percent of Sequences P. E. ≤ 5 X 10^{-1}	1
Number of Times Delta T Exceeded Limits	1
Number of Times Channel (Phase) Sync Was Lost	1
Number of Times Frame Sync Was Lost	1
Number of Times Sequence Sync Was Lost	1
Total Internal Parity Errors	1
Process Number	1
Front-End Malfunction Code	1
Fill Characters	277
Total 24-bit words	320
File Summary Record (51515151,)	1

3.15 INTERMEDIATE COMPUTER TAPES FORMAT

					EOF	#14			N	EOF	
Tape No 1	File I.D.	Data	...	File Summary		File I.D.	Data	...	Data		End of Tape
	#14	N+1			EOF						
Tape No. 2	File I.D.	Data	...	File Summary		. . .					End of Tape
Tape No m	File I.D.	Data	...								

3.16 SYSTEM OPERATING PROCEDURES

The system operating procedures herein provide the information necessary to operate the F-9 Processor with the CDC 3200 Computer. The processing system includes the F-9 Processor Line, Analog Tape Reproducer, Time Decoder, and the CDC 3200 Computer with five Magnetic Tape Units, a Line Printer, Card Reader, Card Punch, and Control Console.

The procedures are as follows:

PART 1 - DETAILED OPERATING PROCEDURE FOR THE F-9 PROCESSOR LINE.

PART 2 - GENERAL OPERATING PROCEDURE.

PART 3 - COMPUTER PROGRAM OPERATING PROCEDURES.

PART 1 - DETAILED OPERATING PROCEDURE FOR THE F-9 PROCESSOR LINE

The procedure herein provides the computer operator with the steps to follow in setting-up the F-9 Processor Line and associated peripheral equipment to process telemetry data recorded on magnetic tapes with the CDC 3200 Computer. Also included are operational checkout procedures to determine satisfactory operation of the system using the Internal PFM Simulator and the external SPS-2000 Stored Program Simulator.

STEP 1 - TURNING THE LINE ON:

A. F-9 Processor Line -

1. Set the POWER toggle switches on the 3 DC power supplies to ON.

2. Set the circuit breakers on the 3 DC power supplies and the 3 AC power supplies to ON.

3. Set the POWER toggle switch on the oscilloscope (RM35A) to ON.

4. Set the POWER toggle switch on the Electronic Counter (HP5532A) to ON.

5. Push the pushbutton switch on the Master Power Control Unit.

6. Set the STANDBY/OPERATE toggle switch on the HP Signal Frequency Synthesizer to OPERATE.

B. STARS Time Decoder - Set the circuit breakers on the AC Power Control Unit to ON.

C. Analog Tape Transport - push the POWER pushbutton switch to turn power ON.

D. Stored Program Simulator (SPS-2000) -

1. Set the MODE SELECTOR switch to the MEMORY READ position.

2. Set the POWER toggle switch to ON.

STEP 2 - SETTING THE LINE PROCESSING RATE:

A. F–9 Processor Line - select the desired CHANNEL PERIOD (located on the SYSTEM CONTROL panel) in accordance with the following table:

Processing Rate	System Control Panel	Time Decoder			Analog Tape Reproducer
	Channel Period	Tape Speed	2 (Switches)	Flywheel out	Tape Speed
1C	20 MS	4 x		4 KC	15 ips
2 c	10 MS	8 X		8 KC	30 ips
4 c	5 MS	16 X		16 KC	60 ips

B. Time Decoder -

1. Connect the INPUT jack on the HP counter to the FLYWHEEL OUTPUT jack on the Time Decoder.

2. Set the HP Counter MODE switch to the "1" position on COUNT TIME SEC.

3. Set the HP Counter SENSITIVITY control to the "1 VOLT RMS" position.

C. ANALOG TAPE REPRODUCER - select the proper speed in accordance with the above table.

STEP 3 - SETTING THE LINE PROCESSING MODE:

A. Digital Sync Mode -

1. PATCH PANEL–

   a. Connect AD/IN to AGC.
   b. Connect CTR to TRANS.
   b. Connect CORR IN to signal jack (Channel 3 or 5).

2. SYSTEM CONTROL Panel -

pus

Use	Digi-Switch setting	TRANS frequency
Normal setting (Test)	6 553 6 0	819.2 kHz
Station tape	6 561 7 0	820.212 kHz

b. Set the ANALOG/DIGITAL switch to the DIGITAL position.

c. Set the AFC/MANUAL toggle switch to the AFC position.

B. Analog Sync Mode:

1. PATCH PANEL -

a. Connect AD/IN to ANA SYNC.

b. Connect CTR to TRANS.

2. SYSTEM CONTROL Panel -

a. Set the AFC/MANUAL toggle switch to the MANUAL position. With the line in this mode, the HI/CORRECT/LOW FREQUENCY indicator lights are disabled.

b. Set the synthesizer frequency with the FREQUENCY SELECT digi-switches, then press the LOAD pushbutton and monitor the reading on the HP Counter. Once Phase sync has been acquired, the system will hold Phase sync after the signal source is removed. It is necessary to press the SYSTEM RESET pushbutton to drop Phase sync.

STEP 4 - CONNECTING THE SIGNAL SOURCE

A. Common to all signal sources (Internal Simulator, External Simulator, and Analog Tape Reproducer):

1. PATCH PANEL –

   a. Jumper the AGC jack to the ANA/IN jack.

   b. Connect the RM 35A Oscilloscope inputs as follows:

      CH SYNC to SYNC A
      DA/AVG to Channel B
      AGC to Channel C
      A SYNC to Channel D

2. SIGNAL D & F CONTROL Panel -

   a. Set the CHAN SYNC toggle switches to 1000.

   b. Set the AGC toggle switches to 1100.

   c. Set the LOCAL/COMP switch to the LOCAL position and then return to the COMP position.

   d. Set the OPERATE/TEST switch to the OPERATE position.

3. SYSTEM CONTROL Panel - push the SYSTEM RESET pushbutton. (Any time the LOCAL/COMP switch is returned to the COMP position, it is necessary to reset the system by pressing the SYSTEM RESET pushbutton switch).

4. RM 35A Oscilloscope -

   a. Set the controls as follows:

TIME BASE B:	TRIGGERING MODE to EXT. (+) for Digital Sync.
TIME BASE A:	TRIGGERING MODE to EXT. (+) for Analog sync.
Channel A:	VOLTS/CM to 10, MODE to DC NORM.
Channel B:	VOLTS/CM to 10, MODE to DC NORM.
Channel C:	VOLTS/CM to 2, MODE to DC NORM.

   b. Connect SYNC B to TIME BASE B Trigger Input.

B. Operation with the Internal PFM Simulator:

1. PATCH PANEL–

   a. Connect SIM OUT to CORR IN.

   b. Connect SIM to CTR.

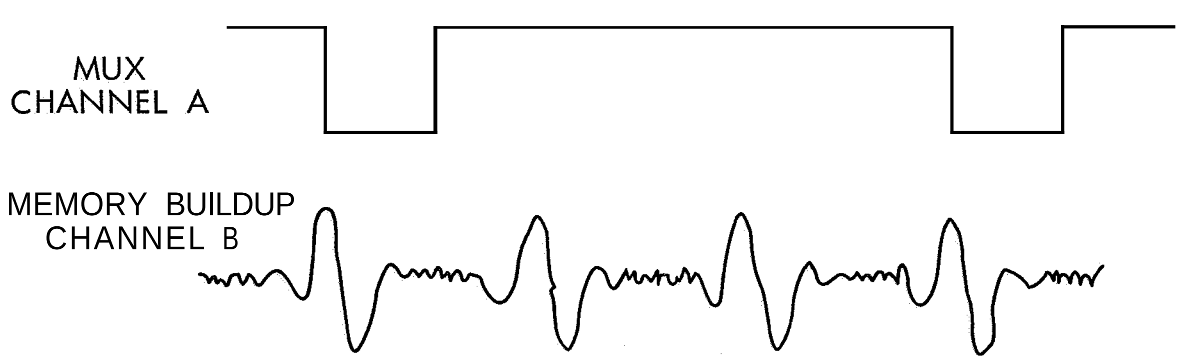
OUTPUT		FREQUENCY	
Switch	Position	Switch	Position
SIG/SIG & SYNC/SYNC	SIG & SYNC	AUTO/MANUAL	AUTO
TAPE ROLL OFF	OUT	MV/XVCO	XVCO
CHANNEL PERIOD	REMOTE	HI/LO	LO
		INT/EXT	INT (back panel)

   b. Adjust the FREQUENCY control for an 819.2 kHz frequency as indicated on the HP Counter.

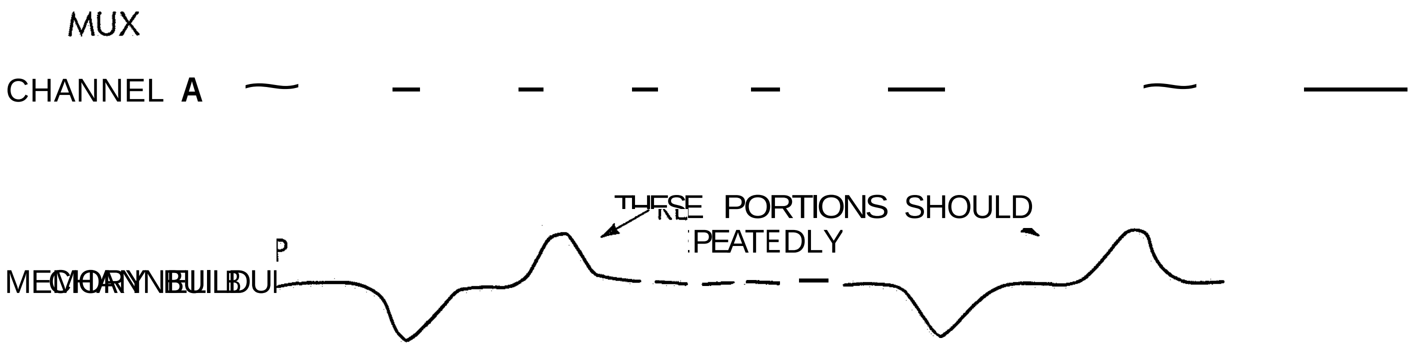
   c. Adjust the AMP control for an AGC signal of approximately 7 volts peak-to-peak as indicated on Channel C of the oscilloscope.

   d. Connect TRANS to CTR.

   e. In the Digital Sync Mode, the memory build-up on Channel B of the RM 35A Oscilloscope should be symmetrical about ground with a display similar to the following:



f. In the Analog Sync Mode, the memory build-up should be similar to the following:



3. SYSTEM CONTROL Panel - press the SYSTEM RESET pushbutton to reset the system.

C. Operation with the SPS-2000 Stored Program Simulator:

1. Follow the set-up for the Internal PFM Simulator, except set the INT/EXT switch to the EXT position.

2. SPS-2000 stored Program Simulator -

a. Press the MANUAL R/W - SINGLE PULSE pushbutton.

b. Turn the MODE SELECTOR switch to the RUN position.

c. Press the START pushbutton. The ADDRESS AND DATA REGISTER lamps should have a continuously shifting pattern.

D. Analog Tape Reproducer:

1. PATCH PANEL -

a. Connect tape reproducer DATA Channel to CORR IN.

b. Connect tape reproducer BCDT channel to BCD TIME.

2. Tape Deck

a. Load the analog tape on the tape playback unit (rewound tape on top reel).

b. Connect tape SYNC to proper channel.

c. Select proper tape speed.

d. Set the TAPE/TACH switch to the TAPE position.

e. Start the tape running.

f. Check for good sync indication.

g. Set the DATA channel REP GAIN for an AGC signal amplitude (Channel C of the RM 35A oscilloscope) of approximately 7 volts peak-to-peak. Insure that the controls on the SIGNAL D & F CONTROL panel are set properly.

h. Set the BCDT channel REP GAIN as indicated by the BCD VOLTAGE LEVEL lights on the Time Decoder. Check that the Time Decoder is up-dating properly.

i. Stop and rewind the tape to the start of data.

3. SYSTEM CONTROL Panel - press the SYSTEM RESET pushbutton and check that the OPERATE light is lit and the TEST light is out.

4. The F-9 Processor Line is now set up for processing data with the the CDC 3280 Computer. To start processing data, press the RUN pushbutton on the Analog Tape Reproducer. The computer "connects" when the CONNECT 1 & 2 lights on the SYSTEM CONTROL panel illuminate. When the CHANNEL SYNC indicator lights the computer has acquired Channel Sync.

STEP 5 - LINE TURN-OFF

A. SPS-2000 Stored Program Simulator (this sequence must be followed!):

1. Press the STOP pushbutton switch.

2. Set the MODE SELECTOR switch to the MEMORY READ position.

3. Press the MANUAL R/W pushbutton switch.

4. Turn the power OFF.

B. Other Equipment:

1. Set the Frequency Synthesizer to STANDBY.

2. Turn the Analog Tape Reproducer OFF.

3. Turn the Time Decoder and the peripheral equipment OFF.

4. Turn the F-9 Processor OFF.

5. Turn the RM 35A Oscilloscope OFF.

PART 2 - GENERAL OPERATING PROCEDURE

STEP 1 - EQUIPMENT SET UP

A. Set up the F-9 Processor Line with an analog tape input (per Part 1).

B. PRELIMINARY

1. Select mode - Analog or Digital.

2. Select processing rate - X1C, X2C, or X4C.

   a. Select Tape Transport tape speed - 15 ips, 30 ips, or 60 ips.

   b. Select F-9 Line CHANNEL PERIOD - 20 ms, 10 rns, or 5 ms.

   c. Select Time Decoder tape speed (2 switches) - X4, X8, or X16 and adjust the FLYWHEEL CLOCK to 4 kc, 8 kc, or 16 kc.

3. Preset Channel 4 Word

   a. Select one Sync I.D. bit

   b. Select Sync Mode bit - ANALOG or $\overline{\text{ANALOG}}$

   c. Set AGC value to 1100

4. Frequency Selection - Select frequency with digiswitches on F-9 Line SYSTEM CONTROL panel.

5. Patch Panel (see Part 1).

   a. Analog Tape Reproducer channels

   b. AGC signal

C. PRE-PROCESSING CHECK - run the analog tape to insure that:

   1. The Analog Tape Reproducer reproduce levels are adjusted properly (AGC set to 7 vpp).

   2. The Time Decoder BCD register is updating.

   3. And the F-9 Processor has acquired Phase sync.

D. Put the F-9 Processor Line in the OPERATE mode by placing all test switches in the OPERATE or COMPUTER position. Verify that the OPERATE indicator light is ON and reset the line by pressing the SYSTEM RESET pushbutton located on the SYSTEM CONTROL panel.

E. Equip the computer magnetic-tape units (LUN's) as required by the program.

   1. Check that there is a sufficient supply of paper in the Line Printer, Console Typewriter and blank cards in the Card Punch.

   2. Load the Card Reader with Program Call cards and File I.D. cards when required by the program.

   3. Check for a READY condition on all units.

   4. Load the program and answer the questions on the Console Typewriter.

   5. Reset the F-9 Processor Line, start the analog tape, wait until PHASE SYNC has been acquired and then push the GO pushbutton on the Computer Console.

STEP 2 - PROCESSING CONDITIONS

A. Two magnetic tapes on Channel 1 or Channel 5 dialed to the same unit (LUN or L.U.) number will halt processing.

B. The Console Typewriter will instruct the operator to READY the equipment when the equipment is not in the READY condition. After putting the flagged equipment in the READY condition, push the CLEAR button on the Computer Console to continue. Typical messages are:

1. READY magnetic tape units: Put a tape on the unit called or push READY on the unit.

2. READY **60:** The Line Printer is in a STOP condition or out of paper.

3. READY **61:** The **Card** Reader is looking for a punchcard to read.

4. READY **62:** The Card Punch requires a supply of cards or the card it is attempting to extract from the deck is damaged.

5. CH. 4 REJECTED: Check that the F-9 Processor Line is in the OPERATE mode (OPERATE Indicator illuminated) and push the SYSTEM RESET pushbutton located on the SYSTEM CONTROL panel.

C. Typewriter messages that can be received during processing:

1. LOSS OF FRAME SYNC: If this is received repeatedly, check the F-9 set up and the PFM-signal quality.

2. LOSS OF PHASE SYNC: If this is received repeatedly check the reproduce level of the PFM-data on the Analog Tape Reproducer and the PFM-signal quality.

3. CHANNEL SYNC NOT FOUND: Check the set-up of the F-9 line and the PFM-signal quality.

4. TIME DIFFERENCE OUTSIDE OF TOLERANCE: If this is received repeatedly check the BDCT-signal level on the Analog Tape Reproducer, the Time Decoder FLYWHEEL CLOCK, and the Time Decoder TAPE SPEED selection.

5. STATION NOT LISTED IN STATION TABLE: The Analog File I.D. card is not punched properly.

PART 3 - COMPUTER PROGRAM OPERATING PROCEDURES

A. LIST OF COMPUTER PROGRAMS:

1. DIMPFOLP: Digital On-Line Processing

   AIMPFOLP: Analog On-Line Processing

2. F9SAD, D: F9 Semi-Automatic Diagnostic, Digital Sync Mode

   F9SAD, A: F9 Semi-Automatic Diagnostic, Analog Sync Mode

   F9SAD, DT: F9 Semi-Automatic Diagnostic, Digital Mode BCD Time Analysis, Digital Mode

   F9SAD, AT: F9 Semi-Automatic Diagnostic, Analog Mode BCD Time Analysis, Analog Mode

3. DIMPFPNT: Digital Direct Print

   AIMPFPNT: Analog Direct Print

4. IFSINTPT: Intermediate Tape Print

5. IF9BUPNT: F-9 Buffer Tape Print

6. IF8BUPNT: F-8 Buffer Tape Print

7. F8EXEC: F-8 to F-9 Intermediate Tape Translation.

B. DETAILED PROGRAM OPERATING PROCEDURES:

PROGRAM 1 - ON-LINE PROCESSING

DIMPFOLP: Digital On-Line Processing.

AIMPFOLP: Analog On-Line Processing.

Equipment Requirements:

1. F-9 Processor Line with an Analog Tape input.

   a. For the DIMPFOLP program, select the Digital Sync Mode.

5

b. For the AIMPFOLP program, select the Analog Sync Mode.

2. System Tape (SCOPE F9 Tape) on Channel 1, Equipment 0, Unit 0.

3. Three (3) Intermediate Tapes

#1 on Channel 5, Equipment 0, Unit 2;

#2 on Channel 1, Equipment 0, Unit 2;

#3 on Channel 5, Equipment 0, Unit 2, when Intermediate Tape #1 is completed.

4. Line Printer.

5. Card Punch.

6. Card Reader loaded with Program Call cards and analog File ID cards.

Operating Procedures:

1. Put all equipment in the READY condition.

2. Perform CDC 3200 SCOPE Operational Procedures to read SEQUENCE card.

3. Answer SEQUENCE on the typewriter with a period (.) and push CLEAR to load program.

4. After the program is loaded and comes to the initial HALT, push GO to obtain the process questions on the Console Typewriter (a total of eight). After each question is answered, the computer will automatically go to the next question.

   a. OPERATOR'S INITIALS: Answer with operator's first, middle, and last.

   b. TIME: Time the processing is being performed in hours and minutes. Example: for 2:30 p.m. answer 1430.

   c. DATE: Day the processing is being performed; month, day, and year. Example: for May 10, 1967 answer 051067.

d. PROCESS NUMBER: The number of times the analog tape has been processed.

e. TAPE UNIT PROCESSING: Answer A or B.

f. TAPE UNIT RECORDING: Serial number of the analog tape recorder at the station.

g. DIGITAL TAPE NUMBER 1: Intermediate Tape #1 number.

h. DIGITAL TAPE NUMBER 2: Intermediate Tape #2.

5. When the typewriter prints the command - WAIT UNTIL PHASE SYNC ACQUIRED, THEN PUSH GO - reset F-9 line, start analog tape and push GO when the PHASE SYNC light on the F-9 Line comes on. Verify that the computer acquires CHANNEL sync by the illumination of the CHANNEL SYNC light on the F-9 line.

6. There are two options for terminating a file:

   a. To terminate a file before PFM data ends, push SELECT JUMP 6.

   b. To terminate a file after PFM data ends, push the INTERRUPT button on the SYSTEM CONTROL panel of the F-9 Line, and then reset the line by pressing the SYSTEM RESET pushbutton.

7. Stop the Analog Tape Reproducer.

8. To restart processing, check READY on the Card Reader and return to step 4 of this procedure.

9. Processing will start on Intermediate Tape #1. When this tape reaches END OF TAPE, it will automatically unload and the processing will continue on Intermediate Tape #2. At this time, remove Intermediate Tape #2 and put Intermediate Tape #3 on Unit 2 (not normally used).

10. To terminate processing on an intermediate tape, write a double END OF FILE by pushing SELECT JUMP 2, then push INTERRUPT on F-9 line and push GO. The intermediate tape will automatically unload.

11. To restart a file, when a false start occurs, push MANUAL INTERRUPT and back-load one File I.D. in Card Reader.

12. At completion of processing, recover the Code 4 Accounting and Quality cards from the Card Punch.

13. After each intermediate tape is completed, remove the tape from the tape deck and put the following label on the reel:

LABEL SAMPLE

(Color: Brown and White)

SATELLITE	DENSITY	TAPE NAME	NUMBER	NO. FILES	DATE	CHANNEL DRIVE
IMP-F	HI	(White) INTER #XXXX		XX	ex. 12-25-66	ex. CH 1, CH 4, ETC.

PROGRAM 2 - SEMI-AUTOMATIC DIAGNOSTIC

F9SAD, D.: F-9 Semi-Automatic Diagnostic, Digital Sync Mode.

F9SAD, A.: F-9 Semi-Automatic Diagnostic, Analog Sync Mode.

F9SAD, DT: F-9 Semi-Automatic Diagnostic, Digital Mode BCD Time Analysis.

F9SAD, AT: F-9 Semi-Automatic Diagnostic, Analog Mode BCD Time Analysis.

Equipment Requirements:

1. F-9 Processor Line with a 563 Analog Tape Input.

   a. For the F9SAD, D. program, select the Digital sync mode.

   b. For F9SAD, A. program, select the Analog sync mode.

   c. For the F9SAD, DT. program, select the Digital sync mode.

d. For the F9SAD,AT. program, select the Analog sync mode.

2. System Tape (SCOPE F9 Tape) on Channel 1, Equipment 0, Unit 0.

3. Magnetic Tape on LUN 01. (This is an optional requirement).

4. Line Printer.

5. Card Punch.

6. Card Reader loaded with Program Call cards.

Operating Procedure:

1. Put all equipment in the READY condition.

2. Perform CDC 3200 SCOPE Operational Procedures, typing-in data and time as requested until a SEQUENCE card is read.

3. Answer SEQUENCE on the Console Typewriter with a period (.) and push CLEAR to load the program.

4. After the program is loaded and the computer comes to halt, select the SELECT JUMP options (normally only SJ 3 is used).

5. Reset the F-9 Line, start the analog tape, wait until phase sync is acquired and then push GO. Verify that the computer has acquired CHANNEL sync by the illumination of the CHANNEL SYNC light on the F-9 Line.

6. After 10 sequences, the computer will print a summary and come to a halt. (not applicable for time analysis)

7. To terminate processing before 10 sequences, push the INTERRUPT pushbutton on the F-9 Line SYSTEM CONTROL panel.

8. To restart the processing, wait until PHASE sync is acquired and then push GO.

Error Messages:

1. CALL ERROR, CONSULT OPERATION MANUAL:
The program was not loaded with the correct calling procedure or option.

2. FETCH POINTER BEHIND FRONT END:
Unrecoverable error, caused by processing of data not staying ahead of input data. NOGO summary print exit is taken.

3. FORMAT ERROR:
Data does not contain format flag, possibly resulting in a data slippage. NOGO summary print exit is taken.

4. CHANNEL 4 REJECTED:
Determine cause and then press GO.

PROGRAM 3 -DIRECT PRINT

DIMPFPNT: Digital Direct Print.

AIMPFPNT: Analog Direct Print.

Equipment Requirements:

1. F-9 Processor Line set up with an Analog tape input.

   a. For the DIMPFPNT program, select the Digital *Sync* Mode.

   b. For the AIMPFPNT program, select the Analog Sync Mode.

2. System Tape (SCOPEF9 Tape) on Channel 1, Equipment 0, Unit 0.

3. Buffer Tape on Channel 1, Equipment 0, Unit 2. The Buffer Tape is required to obtain the W1, W2, W3, and W4 format, but is not required for a direct W1 printout.

4. Line Printer.

5. Card Reader loaded with Program Call cards and analog File I. D. cards for each file to be printed.

Operating Procedure:

1. Put all equipment in the READY condition.

2. Perform CDC SCOPE Operational Procedures to read SEQUENCE card.

3. Answer SEQUENCE on the Console Typewriter with a period (.) and push CLEAR to load program.

4. Select the SELECT JUMP options.

5. To start processing, reset the F-9 line, start the analog tape, wait until PHASE sync is acquired and then push GO. Verify that the computer has acquired CHANNEL sync by the illumination of the CHANNEL SYNC indicator on the F-9 Line.

6. To terminate processing with an END OF FILE, push SELECT JUMP 6.

7. To restart processing, remove SELECT JUMP 6 and push GO.

PROGRAM 4 - INTERMEDIATE TAPE PRINT

IFSINTPT: Intermediate Tape Print

Equipment Requirements:

1. System Tape (SCOPEF9 Tape) on Channel 1, Equipment 0, Unit 0.

2. Intermediate Tape on Channel 5, Equipment 0, Unit 0.

3. Line Printer.

4. Card Reader loaded with Program Call cards.

Operating Procedure:

1. Put all equipment in the READY condition.

2. Perform CDC SCOPE Operational Procedures to read SEQUENCE card.

3. Answer SEQUENCE on the typewriter with a period (.) and push CLEAR to load the program.

4. Select the appropriate SELECT JUMP options.

5. After the program is loaded, the Console Typewriter will ask three questions regarding the information to be printed: FILES

TO SKIP, RECORDS TO BE SKIPPED, and RECORDS TO BE PRINTED. After each answer, the computer will automatically go to the next question. When the third answer is completed, the computer will start printing. (NOTE: The File I.D. and File Summary are counted as records).

6. When printing is completed, the Console Typewriter will summarize the print instructions and instruct the operator on how to continue, either by asking the first question for the next print, or by instructing the operator to push GO.

7. If the typewriter asks, "Is this F8 or F9?", answer with digit 9.

PROGRAM 5 - F-9 BUFFER TAPE PRINT

IF9BUPNT: F-9 Buffer Tape Print

Equipment Requirements:

1. System Tape (SCOPEF9 Tape) on Channel 1, Equipment 0, Unit 0.
2. Buffer Tape on Channel 1, Equipment 0, Unit 2.
3. Line Printer.
4. Card Reader loaded with Program Call cards.

Operating Procedure:

1. Put all equipment in the READY condition.
2. Perform CDC SCOPE Operational Procedures to read SEQUENCE card.
3. Answer SEQUENCE on the Console Typewriter with a period (.) and push CLEAR to load the program.
4. When the program is loaded, the computer will come to a halt; select the SELECT JUMP options and push GO.
5. Answer the three questions the typewriter will ask - FILES TO SKIP, RECORDS TO SKIP AND RECORDS TO PRINT. After each answer the computer will automatically go to the next question.

When, the third answer is completed, the computer will start printing. (NOTE: The File I.D. and the File Summary are counted as records).

6. When the printing is completed, the typewriter will have the instructions on how to continue, either by asking the first question for the next print, or by instructing the operator to push GO.

7. If the typewriter asks, "IS THIS F8 OR F9?", answer with the digit 9.

PROGRAM 6 - F-8 BUFFER TAPE

IF8BUPNT: F-8 Buffer Tape Print

Equipment Requirements:

1. System Tape (SCOPEF9 Tape) on Channel 1, Equipment 0, Unit 0.

2. F-8 Buffer Tape on Channel 1, Equipment 0, Unit 2.

3. Line Printer.

4. Card Reader loaded with Program Call cards.

Operating Procedures:

1. Put all equipment in the READY condition.

2. Perform CDC SCOPE Operational Procedures to read SEQUENCE card.

3. Answer SEQUENCE on the Console Typewriter with a period (.) and push CLEAR to load the program.

4. Answer the three questions the typewriter will ask - FILES TO SKIP, RECORDS TO SKIP, AND RECORDS TO PRINT. After each answer, the computer will automatically go to the next question. When the third answer is completed, the computer will start printing. (NOTE: The File I.D. and File Summary are counted as records.)

5. When the printing is completed, the typewriter will have the instructions on how to continue, either by asking the first question for the next print, or by instructing the operator to push GO.

6. If the typewriter asks, "IS THIS F8 OR F9?", answer with digit 8.

PROGRAM 7 - F-8 EXEC PROGRAM

F8EXEC: F-8 to F-9 Intermediate Tape Translation.

Equipment Requirements:

1. Computer Configuration: 16-K CDC 3200, at least 3 CDC 607 Tape units, Line Printer, and Card Reader.

2. Computer Setup: As for normal SCOPE run.
   Tape Assignments:

   a. System Tape (SCOPEF9 Tape) on Channel 1, Equipment 0, Unit 0.

   b. F-8 Buffer Tape on Channel 1, Equipment 0, Unit 1 (LUN 10.)

   c. Intermediate Tape on Channel 5, Equipment 0, Unit 2 (LUN 20.)

Operating Procedure:

1. Load SEQUENCE, JOB, EQUIP, Program Call card, and Analog Tape cards for each file of the F8 Buffer Tape, followed by END and END FILE card, into the card reader.

2. Put all equipment in the READY condition.

3. Perform CDC SCOPE Operational Procedures to read SEQUENCE card.

4. Answer SEQUENCE on the Console Typewriter with a period (.) and push CLEAR to load the program.

5. The following Console Typewriter messages require operation action:

Message: MOUNT INPUT TAPE ON L.U. 10 OUTPUT TAPE ON L.U. 20
READY?

Action: Mount a buffer tape from the F-8 Line on L.U. 10 and a scratch tape for the intermediate digital output on L.U. 20. When ready, press "FINISH".

Message: OPERATOR INITIALS (USE 3 LETTERS).

Action: Type in operator initials as directed and press "FINISH".

Message: TIME (USE 4 DIGITS)

Action: Type in 24 hour time as directed and press "FINISH".

Message: DATE (USE 6 DIGITS).

Action: Type in date as YRMODA and press "FINISH".

Message: DIGITAL TAPE NUMBER (USE 5 DIGITS).

Action: Type in the digital tape number assigned by Operations as directed and press "FINISH".

This number will begin a 00001 for the first orbit of data.

Message: DIGITAL TAPE REEL NUMBER (USE 2 DIGITS).

Action: Type in reel number assigned by operations as directed and press "FINISH**.

This number will begin a 01 for the first reel of each orbit. The program automatically increases the reel number if an additional reel is started during a run. Each separate run to continue the data for an orbit will be assigned a new reel number.

Message: SAVE INPUT TAPES FROM L.U. 10 AND OUTPUT TAPES FROM L.U. 20.

Action: Label the tapes as directed and return to Operations.

Message: LOGICAL EOT ON L.U. 10
MOUNT NEXT INPUT TAPE ON L.U. 10
READY?

Action: Mount next buffer tape from the F-8 Line as directed and press "FINISH".

Message: EOT ON L.U. **20**
MOUNT NEXT OUTPUT TAPE ON L.U. **20**
READY?

Action: Mount a scratch tape for the next intermediate digital output as directed and press "FINISH".

Message:

	SAT	STA	ANTPNO	BFTPNO	YR	MO	DA
ANALOG CARD	**1**	**3**	**3205**	**6922**	**7**	**1**	**27**
BUFFER ID	**0**	0	**3205**	**6922**	**7**	**1**	**27**

PROCESS THIS FILE?

Action: This message only comes out when the indicated items on the analog card and the buffer I.D. do not agree. To skip processing of this file, type in NO and press "FINISH". To process this file identified according to the analog card, type in YES and press "FINISH".

Note: When entering any message, type-in messages may be corrected by pressing "REPEAT" and retyping the message as indicated. This must be done before "FINISH" is pressed.

6. If the information on the analog File I. D. card and the Buffer Tape I. D. do not agree, both I. D. 's will be printed on the Console Typewriter with the question-PROCESS THIS FILE? To skip the file, answer NO and to process the file, answer YES. Push CLEAR after the desired answer is given.

7. If END OF TAPE is reached on either magnetic tape, the Console Typewriter will identify the condition. Mount a new tape on the appropriate unit and push CLEAR to continue processing.

8. When all of the analog File I.D. cards are used, the END card will terminate processing. The Console Typewriter will print SAVE INPUT TAPE FROM L.U. 10 AND OUTPUT TAPES FROM L.U. 20. Unload the magnetic tapes and attach the proper identifying labels on the reels.

IMP-F F8 ANALOG TAPE I.D. CARD FORMAT

Column	Identification	
1-4	Satellite number	
5-7	Station number	
9-12	Analog tape number	
13	Date of recording	(Year)
14-15	Date of recording	(Month)
16-17	Date of recording	(Day)
18-22	Buffer tape number	
23-26	Orbit number	
31-32	Buffer tape file number	
34-35	Analog tape start time	(Hour)
36-37	Analog tape start time	(Minute)
38-39	Analog tape start time	(Second)
41-42	Analog tape stop time	(Hour)
43-44	Analog tape stop time	(Minute)
45-46	Analog tape stop time	(Second)
48	Date tape received	(Year)
49-50	Date tape received	(Month)
51-52	Date tape received	(Day)
53-55	Tape evaluation code	
56-57	Date tape evaluated	(Year)
58-59	Date tape evaluated	(Month)
60-61	Date tape evaluated	(Day)

Column	Identification
62	2 = F-8 analog-to-digital line I.D.
63	Process number
64-73	Tape unit recording

IMP-F F8 END CARD FORMAT

Column	Contents
1-3	END

An End of File card may be substituted for this card.

UNIVAC 1108

COMPUTER PROGRAMS

UNIVAC 1108 COMPUTER PROGRAMS

4.1 IMP-F TIME CORRECTION AND DECOMMUTATION PROGRAM

The IMP-F Time Correction and Decommutation Program time-corrects and decommutates the telemetry data from the IMP-F satellite. Tapes in a variety of formats are generated for the on-board experimenters, in addition to a time-corrected master data tape and an optical aspect and performance parameter tape. This program is written in FORTRAN IV and UNIVAC 1108 ASSEMBLER language. The program is designed to run on a UNIVAC 1108 Computer under the EXEC II Monitor.

The program is designed to decommutate data for any combination of experimenters and to bypass time correction using the time-corrected master data tape as an input to the decommutation phase. The experimenter programs are independent from one another and may be bypassed by lead-card option.

4.1.1 Card Input Format

The primary control input card permits four selections in columns one through four inclusive. The user may choose to define processing with or without existing history or orbit data. He may also choose between a normal run or a "Quick Look" run. He may select processing for master or intermediate digital tape input. Selection of these options is binary coded in the card.

Card columns five through fifteen, inclusive, permit selection or supression of output for the eleven experiments controlled. Coding is binary for these selections.

Card columns sixteen through twenty-one are not used.

Card columns twenty-two through twenty-nine are used to select the various output options of the program.

Card column thirty is not used.

Card columns thirty-one through forty-two, coded in Hollerith, define the reel number and date of the run. These must match the equivalent information in the input tapes.

CARD COLUMN	FORMAT	IDENTIFICATION
1	I1	Time Correction History Option 1 = History 0 = No History
2	I1	Orbit Data Option 1 = Orbit Data 0 = No Orbit Data
3	I1	Run Option 1 = Quick Look Run 0 = Normal Run
4	I1	Tape Option 1 = Master Digital Tape Input 0 = Intermediate (CDC 3200) Tape Input

Columns 5 thru 15 are experimenter option flags 1 = process, 0 = bypass

5	I1	University of Maryland
6	I1	APL
7	I1	Mag. Field Experiment/Dr. Ness
8	I1	University of California
9	I1	University of Chicago
10	I1	SCAS
11	I1	TRW
12	I1	BTL
13	I1	Radiation Damage
14	I1	GSFC/Dr. Hagge
15	I1	University of Iowa
16–21		Blank
22–24	I3	0 = Decom Phase I Only 1 = Decom Phase I and II 2 = Decom Phase II Only
25	I1	Raw Data Print Option 0 = No Print 1 = Print
26		Blank
27	I1	OA and PP Print Option 0 = Print 1 = No Print

CARD COLUMN	FORMAT	IDENTIFICATION
28	I1	Input Data Printout Option
		1 = Print
		0 = No Print
29		History Option
		0 = No History
		1 = History
30		Blank
31–33	I3	Orbit Tape ID Reel Number
34–36	I3	Orbit Tape Date of Generation Year
37–39	I3	Orbit Tape Date of Generation Month
40–42	I3	Orbit Tape Date of Generation Day

4.1.2 Magnetic Tape Assignment

The decommutation phase of the program is done in two passes. All magnetic tapes for the first pass must have standard UNIVAC 1108 assign cards included in the deck set-up. Magnetic tapes for the second pass are assigned internally under program control.

The options, assignments, and labels are as follows:

1. Program Load and Go Tape

   $^{7}_{8}$ ASG C = DECOM

2. Master Output Tape

   $^{7}_{8}$ ASG P = MPTOUT

3. Intermediate Input Tape

   $^{7}_{8}$ ASG B = IMPIN

4. University of Chicago

   $^{7}_{8}$ ASG G = CHIC

5. University of Maryland

$^{7}_{8}$ KXER ASG H = UOM

6. University of California

$^{7}_{8}$ KER ASG I = UCAL

7. Magnetic Field/Ness

$^{7}_{8}$ ASG K = NESS

8. Applied Physics Laboratory

$^{7}_{8}$ XOR ASG M = APL

The remainder of the experimenters run on the second pass and the tapes will be assigned internally. Assign cards for the experimenter tapes on the first pass should be included in the deck only if they are selected to run, otherwise the tapes will not be de-assigned at the completion of the first pass.

4.2 ORBIT DATA

The Advanced Orbital Programming Branch (A.O.P.B.) Orbit Determination System will be used to generate an ephemeris tape. The orbit data will be merged with experimenter data onto one tape during the final stage of the Decommutation.

A new program required by the IMP-F for the Orbit Determination System is the Multiple Coordinate Ephemeris Routine. This program accepts the ORB-3A data tape as an input, computes the required items, and outputs a Multiple Coordinate Ephemeris Tape.

4.2.1 Multiple Coordinate Ephemeris Tape

This tape is written in the binary mode at 556 bits-per-inch (bpi). One title record precedes the data records. The number of data records is a function of the time period covered by the tape and of the time interval between the data records. The number of data records will vary from tape to tape. Two end-of-data sentinel records follow the last data record. Two end-of-file marks follow the sentinel records.

4.2.1.1 Title Record for the Binary Multiple Coordinate Ephemeris Tape Format

All fixed-point words are 36 bits long, IBM 7094 format.

All floating-point words are 36 bits long, IBM 7094 format.

Word No.	Form	Identification	
0	Fixed Point	FORTRAN record size indicator = 000375010001, This indicates a word count of 253_{10} words, exclusive of two record size indicator words and a check sum word.	
1	Floating Point	Form of data identification = 74636583_{10}	
2-3	↕	Satellite identification	
4	Floating Point	Date	U. T. Start time of satellite data
5	Floating Point	Day count of year	
6	↕	Seconds of the day	
7		Date	U. T. Stop time of satellite data
8	Floating Point	Day count of year	
9	Floating Point	Seconds of the day	
10	Floating Point	A T in seconds if tape has equal intervals between data records, 0 if tape has unequal intervals between data records.	
11-13	↕	Spares	
14		Number of words per data record = 75_{10}	
15		Spare (zero)	
16-26		Run identification data	
27		Date	Coordinate system reference data, time and position
28		Day count of year	
29		Apparent sideral time in radians	
30-40	Floating Point	Harmonics (if applicable)	

Word No.	Form	Identification
41		
42		
43		
44		
45		
46		Inclination, I (degrees)
47		Right Ascension of the ascending node, Ω (degrees)
48		Rate of change of Ω, $\dot{\Omega}$ (degrees/day)
49		Argument of perigee, ω (degrees)
50		Rate of change of ω, $\dot{\omega}$ (degrees/day)
51		Period, P (minutes)
52		Rate of change of P, $\dot{P}$ (minutes/day)
53–253		
254	Fixed Point	Check sum of words in words numbered 1 thru 253
255	Fixed Point	FORTRAN record size indicator = 000375010001_8 (Same as word 0)

4.2.1.2 Data Record for Binary Multiple Coordinate Ephemeris Tape Format

All words are 36 bits long, IBM 7094 format.

Word No.	Form	Identification	
0	Fixed Point	FORTRAN record size indicator 000113010001, This indicates a total data word count of 75_{10}	
1	Floating Point	Day of year	Time of orbit data in this record
2		Milliseconds of the day	
3		Longitude (degrees)	Satellite position in geocentric coordinates
4		Latitude (degrees)	
5		Longitude (degrees)	Satellite position in geo-magnetic coordinates
6	Floating Point	Latitude (degrees)	

Word No.	Form	Identification	
7	Floating Point	R_o (Earth radii), a geomagnetic coordinate of the satellite position, C. U. L.	
8		r, the radial distance of the satellite from the center of the Earth (km)	
9		GSE_X	Satellite position in Geocentric Solar Ecliptic Coordinates (km)
10		GSE_Y	
11		GSE_Z	
12		GSM_X	Satellite position in Geocentric Solar Magnetospheric Coordinates (km)
13		GSM_Y	
14		GSM_Z	
15		GSE_X	Moon position in Geocentric Solar Ecliptic Coordinates (km)
16		GSE_Y	
17		GSE_Z	
18		GSM_X	Moon position in Geocentric Solar Magnetospheric Coordinates (km)
19		GSM_Y	
20	Floating Point	GSM_Z	
21	Floating Point	GEI_X	Satellite position in Geocentric Equatorial Inertial Coordinates (km)
22	Floating Point	GEI_Y	
23	Floating Point	GEI_Z	
24	Floating Point	GEI_X	Sun position in Geocentric Equatorial Inertial Coordinates (A. U.)
25		GEI_Y	
26		GEI_Z	
27		Longitude	Sub-solar point in geomagnetic coordinates (degrees)
28		Latitude	
29		Distance from the satellite to the Moon (km)	
30		Distance parallel to the X axis from the satellite to the Moon (km)	
31		1st row, 1st column	Geocentric Solar Ecliptic to Geocentric Solar Magnetospheric Transformation Matrix
32		1st row, 2nd column	
33		1st row, 3rd column	
34		2nd row, 1st column	
35	Floating Point	2nd row, 2nd column	

Word No.	Form	Identification	
36	Floating Point	2nd row, 3rd column	Geocentric Solar Ecliptic to Geocentric Solar Magnestospheric Transformation Matrix
37		3rd row, 1st column	
38		3rd row, 2nd column	
39		3rd row, 3rd column	
40		1st row, 1st column	Geocentric Equatorial Inertial to Geocentric Solar Ecliptic Transformation Matrix
41		1st row, 2nd column	
42		1st row, 3rd column	
43		2nd row, 1st column	
44		2nd row, 2nd column	
45		2nd row, 3rd column	
46		3rd row, 1st column	
47		3rd row, 2nd column	
48		3rd row, 3rd column	
49		Right Ascension	Satellite position in celestial inertial (deg)
50		Declination	
51		Right Ascension	Velocity vector in celestial inertial (deg)
52		Declination	
53		Magnitude of velocity (km/second)	
54		L, McIlwain Parameter (Earth radii)	
55		B, Magnetic field strength (Gamma)	
56		B/B_o, ratio of the magnetic field strength to the field strength at the satellite	
57		Satellite - Earth - Sun angle, L_{sep} (degrees)	
58		Satellite - Earth - Moon angle (degrees)	
59		Right Ascension	Magnetic vector in celestial inertial (degrees)
60		Declination	
61		Longitude	Sub-solar point in Geocentric Equatorial Inertial Coordinates
62		Latitude	
63		GSE_X	Theoretical geomagnetic field in Geocentric Solar Ecliptic Coordinates
64		GSE_Y	
65		$_Z$	

Word No.	Form	Identification
66	Floating Point	Type of data indicator: 1 = regular satellite data item 2 = ascending node crossing data item 3 = North point data item 4 = descending node data item 5 = South point data item 6 = Sunlight entrance data item 7 = Sunlight exit data item
67		Date of data (yr, mo, dy)
68		Longitude } Geodetic satellite position (degrees)
69		Latitude }
70		Height above spheroid (km)
71		Ascending node crossing number (pass number)
72	↓	Year of data (yr)
73–75	Floating Point	Zero fill for spares
76	Fixed Point	Check sum of data words in words 1 through 75
77	Fixed Point	FORTRAN record size indicator 000113010001,. This indicates a total data word count of 75_{10} words.

NOTES:

1. Longitude is positive East of Greenwich and negative West of Greenwich (-180" to +180°).

North latitude is positive and South latitude is negative (-90' to +90°).

2. Date of data (word 67) equals the day + 100 (month + year [100]).

Example:

February 10, 1967, at 2 hours U. T. is recorded as 670210 in word 67, 41 in day count (word 1), 7200000 in milliseconds of the day (word 2), and 67 in the year of data (word 72).

4.2.1.3 End of Data Sentinel Record for Binary Multiple Coordinate Ephemeris Tape Format

Word No.	Format	Identification
0	Fixed Point	FORTRAN record size indicator 0001130100018. This indicates a total data word count of 253 words.
1	Floating Point	99999999_{10}
2–75	Floating Point	Irrelevant
76	Fixed Point	Check sum of data words in words 1 through 75
77	Fixed Point	FORTRAN record size indicator 000113010001_8.

4.3 UNIVAC 1108 TAPE FORMATS AND DEFINITION OF COORDINATE SYSTEMS

4.3.1 IMP-F Experimenter Identification

The IMP-F experimenters will be assigned a two-digit integer number which will appear as the first word in the identification record of each experimenter output tape.

Assignments are as follows:

Bell Telephone Labs	01
University of California	02
University of Chicago	03
State University of Iowa	04
Southwest Center for Advanced Studies	05
TRW	06
Applied Physics Lab/GSFC	07
University of Maryland/GSFC	08
Drs. Hagge/McDonald	09
Optical Aspect and Performance Parameters	10
Dr. Ness	11
Radiation Damage, Mosfets	12

4.3.2 IMP-F Experimenter BCD Tape ID Record Format

Item No.	Identification		No. of BCD Characters
1	Experimenter ID		2
2	Satellite ID		8
3	Orbit Number		3
4	Telemetry Recording Station Number		6
5	Analog Tape Number		4
6	Analog-to-Digital Line ID		1
7	Day of Year	Start Time	3
8	Milliseconds of Day		8
9	Day of Year	Stop Time	3
10	Milliseconds of Day		8
11	Average Sequence Time (Milliseconds) This File		5
12	Quick Look Data Flag		1
13	Orbit/No Orbit Data Flag		1
14	Decom Process Date (YY MM DD HR)		8
15	Orbit Tape ID Reel Number		4
16	Orbit Tape Date of Generation (YY MM DD)		6
17	Average Spin Period in Milliseconds		5
18	Year of Start Time		2
19	Year of Stop Time		2
20	Room for Expansion		40

Orbit/No Orbit Data Flag for Experimenter Tape ID Records

0 = No orbit data included on this file. Fill characters are used in orbit item locations.

1 = Final orbit data included on this file.

2 = Preliminary orbit data included on this file.

3 = Predicted orbit data included on this file.

Quick-Look Data Flag for Experimenter Tape ID Records

0 = No sequence clock corrections, no frame time corrections applied to this file therefore, data is "quick-look".

1 = Phase I sequence clock corrections and frame time corrections have been applied to this file, but final corrections have not been made, therefore, data is "quick-look".

2 = Phase I and Phase II sequence and frame time corrections have been made to data on this file.

4.3.3 IMP-F Experimenter Binary Tape ID Record Format

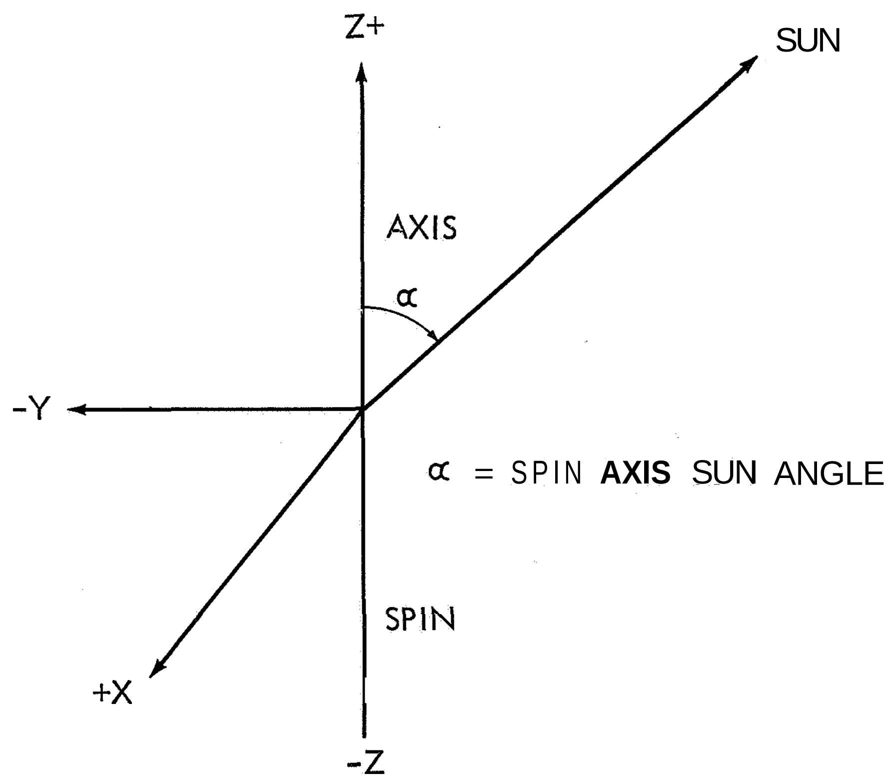
Word No.	Identification	Format
1	Experimenter ID	I
2	Satellite ID	I
3	Orbit number	I
4	Telemetry Recording Station Number	I
5	Analog tape number	I
6	Analog-to-digital line ID	I
7	Day of Year } Start Time for This File	I
8	Milliseconds of Day } Start Time for This File	I
9	Day of Year } Stop Time for This File	I
10	Milliseconds of Day } Stop Time for This File	I
11	Average sequence time (milliseconds) for this file	I
12	Quick-look data flag	I
13	Orbit/No orbit data flag	I
14	Decom process date, year	I
15	Decom process date, month	I
16	Decom process date, day	I
17	Decom process date, hour	I
18	Orbit tape ID reel number	I
19	Orbit tape date of generation, year	I
20	Orbit tape date of generation, month	I
21	Orbit tape date of generation, day	I
22	Average spin period in milliseconds	I
23	Year of start time (Right adjusted, 2 digits)	I
24	Year of stop time (Right adjusted, 2 digits)	I
25-40	Room for Expansion	

4.3.4 IMP-F Optical Aspect Data

Optical aspect data is contained in Frame 12, Channels 1 thru 7 of every telemetry sequence.

Channel 1 is an 8-bit accumulator which is the spin-axis sun-angle (O.A. SCAN). Channels two through seven are divided into 12-bit accumulators (OA1, OA2, OA3, OA4). These accumulators have the following information:

O.A. SCAN = Spin-axis Sun-angle. This is the angle from the satellite-Sun line, measured in the plane which passes through the spin-axis and the Sun. The satellite is to be spin-stabilized about its Z axis, This spin-axis Sun-angle is measured from the +Z axis line to the satellite-Sun line, and may range from 0" to +180°.



O.A. 1 = Sun time. This is the number of counts (at a 400 cycle/sec rate) from Channel 0, Frame 0, until the first Sun pulse.

O.A. 2 = Spin period. This is the number of counts (400 cycle/sec rate) between successive Sun pulses.

O.A. 3 = Time of Earth-horizon. This is the number of counts (400 cycle/sec rate) measured from the first Sun pulse time until the first Earth sensor pulse.

O. A. 4 = Earth-horizon width. This is the number of counts (400 cycle/sec rate) from the horizon pulse leading-edge to the horizon pulse trailing-edge.

IMP-F experimenters will be furnished the optical aspect data as they requested along with their experiment data. The raw data will be converted by our decommutation program and will be on experimenter tapes in the following form:

Data	For BCD Tapes		
	Units	No. of BCD Char.	Assumed Decimal Point
O.A. SCAN	Degrees	5	2 Places to left
O.A. 1	msec	4	Extreme right
O.A. 2	msec	5	Extreme right
O.A. 3	msec	5	Extreme right
O.A. 4	msec	4	Extreme right

For Binary Tapes		
No. of Binary Bits	Assumed Binary Point	Expected Range
16	8 Places to left	0-180 degrees
14	Extreme right	0-3,000 msec
16	Extreme right	2,000-3,000 msec
16	Extreme right	0-20,000 msec
14	Extreme right	0-300 msec

The process our computer program uses to convert the optical aspect data is this:

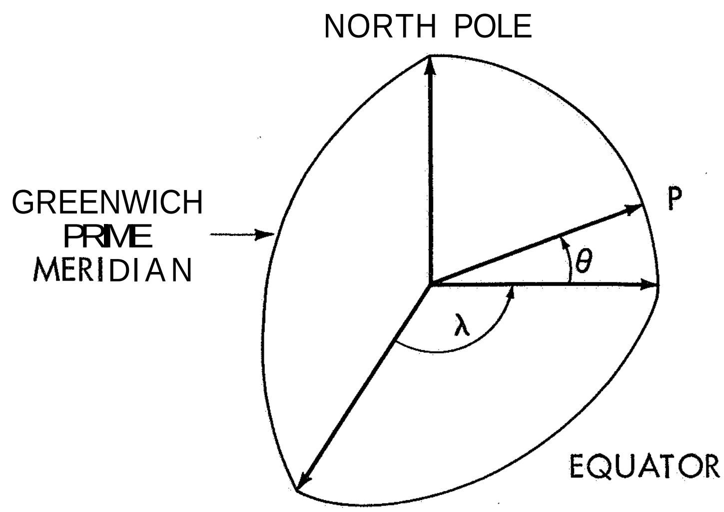
Spin-axis Sun-angle: The 4-bit burst from the first half of Channel 1 is the least-significant bits, and the second half of channel 1 is the most-significant four bits of the 8-bit accumulator. These two bytes are re-ordered, most-significant bits from the left through least-significant bits on the right. This 8-bit byte is now in Gray code. Through a table look-up procedure, this 8-bit number is used to find the proper spin-axis sun-angle from a 256-value table.

Sun-Time: The first half of Channel 2 is the least-significant 4 bits, the second half of Channel 2 is the next four bits, and the first half of Channel 3 is the most-significant bits. This 12-bit accumulator is reordered in this way: most-significant bits on the left, through least-significant bits on the right. Because these are "S" type accumulators, which count from zero, a one must be added, and this number is multiplied by 2.5 to convert from counts to milliseconds.

Time of Earth-horizon: The 12-bit accumulator is reconstructed into most through least-significant bit register, one is added, and this number is multiplied by 2.5. To this number, add the Sun-time in milliseconds for this sequence. The result is the elapsed time in milliseconds from Channel 0, Frame 0 until Earth-horizon pulse.

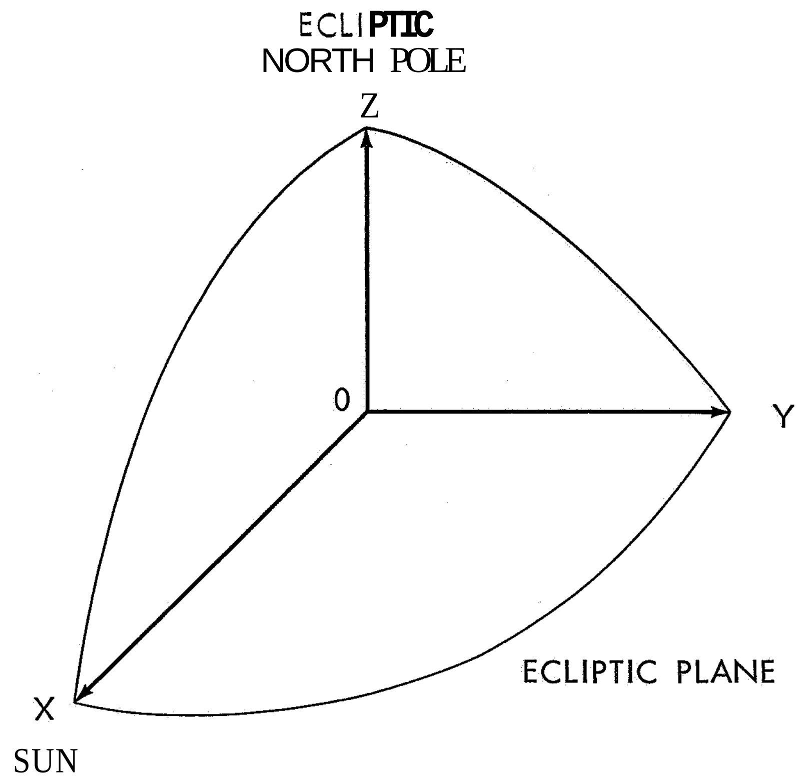
Earth-horizon width: The 12-bit accumulator is reconstructed into most through least-significant bit register, one is added, and this number is multiplied by 2.5 to convert from counts to milliseconds.

4.3.5 Definitions of Coordinate Systems



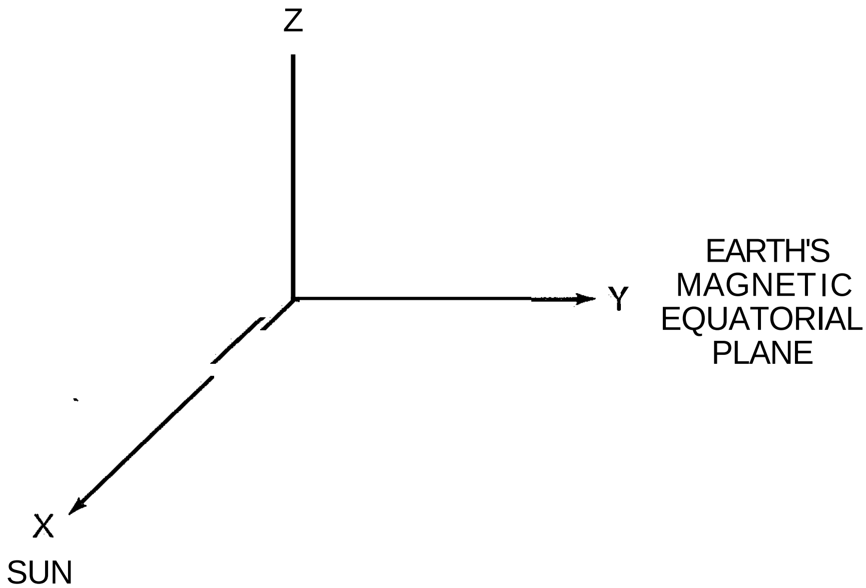
Geocentric Longitude, Latitude

This is an earth-centered coordinate system which is used to locate points on the Earth's surface. The basic planes of reference for this system are the Earth's equatorial plane, and the plane which cuts through the North and South poles and through Greenwich, England. Angles of longitude (A) are measured along the equatorial plane from the Greenwich Prime Meridian to the great circle which passes through the poles and the Earth-surface point. Latitude (θ) is measured from the Equatorial plane to the line from the Earth-center to the Earth-surface point. North latitude is positive, South latitude is negative ($-90° \leqq \theta \leqq +90°$). East longitude is positive, West longitude is negative (-180" 6 A 6 +180°).



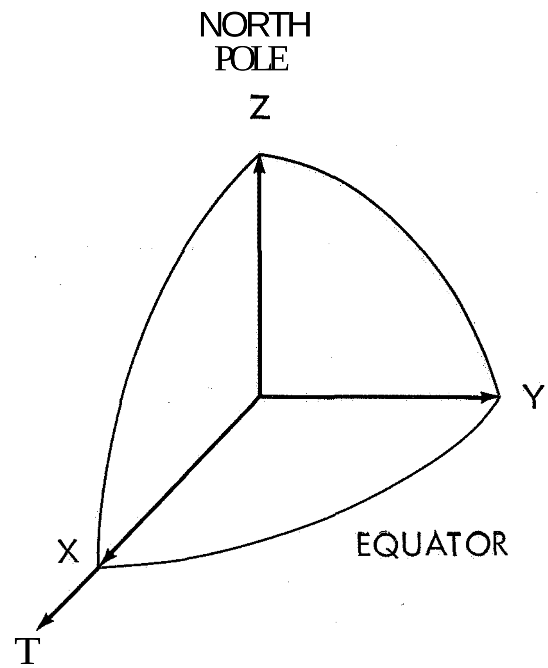
Geocentric Solar Ecliptic Coordinates

The origin of this system is at the center of the Earth. The X–Y plane is the ecliptic plane. The X axis points to the sun. The +Z axis is the cross-product of the X axis and the Y axis, and points to the North ecliptic pole.



Geocentric Solar Magnetosphere Coordinate System

This is an Earth-centered coordinate system. The X axis points to the Sun. The Y axis is in the Earth's magnetic equatorial plane. The Z axis is the cross-product of the X axis and the Y axis. (The Z axis is in the plane defined by the X axis and the geomagnetic dipole axis.)

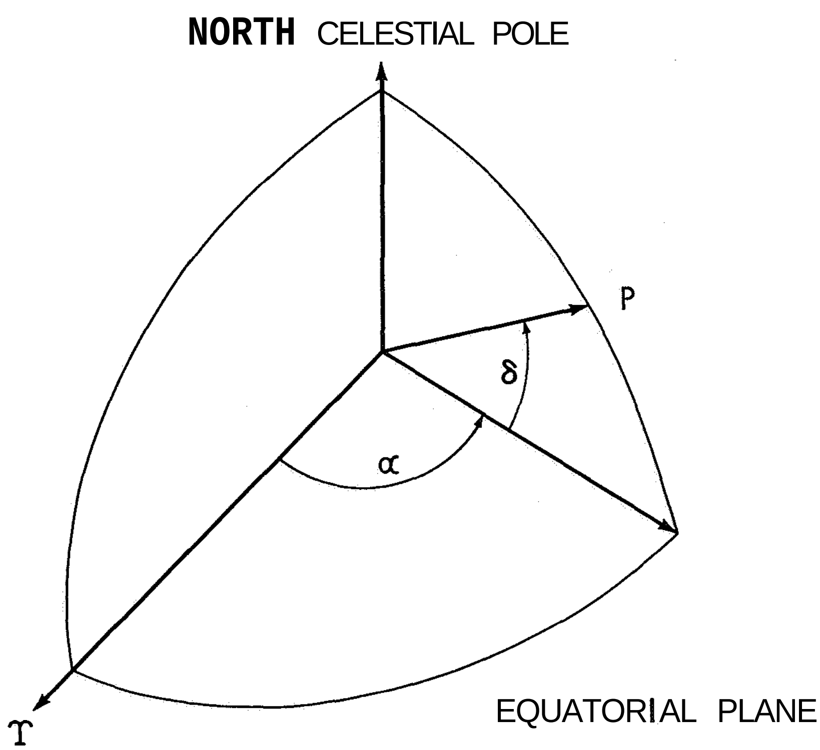


Geocentric Equatorial Inertial Coordinate System
(Also "Universal Coordinate System" or "Celestial Inertial System")

The origin of this system is at the center of the Earth. The X axis is in the Earth's equatorial plane and points to the vernal equinox (first point of Aries, ♈). The Z axis passes through both poles and the Earth's center, the positive Z axis points to the North pole. The Y axis is the cross-product of the Z and X axes, and lies in the Earth's equatorial plane.

Right Ascension and Declination

The reference planes for this coordinate system are the celestial equatorial plane, and the plane which passes through the vernal equinox and the celestial poles. The polar axis is defined as the line perpendicular to the Earth's equatorial plane which passes through the center of the Earth and through the geodetic poles. Right ascension (α) is measured eastward along the equator from the equinox to the great circle which passes through the celestial poles and through the point's projection on the celestial sphere. Declination (δ) is measured from the equatorial plane to the line from the center of the Earth to the point's projection on the celestial sphere. Declination is positive north of the equatorial plane, and negative south of the equatorial plane ($-90° \leq \delta \leq 90°$). Right ascension is measured positively eastward along the equator ($0° \leq \alpha \leq 360°$).



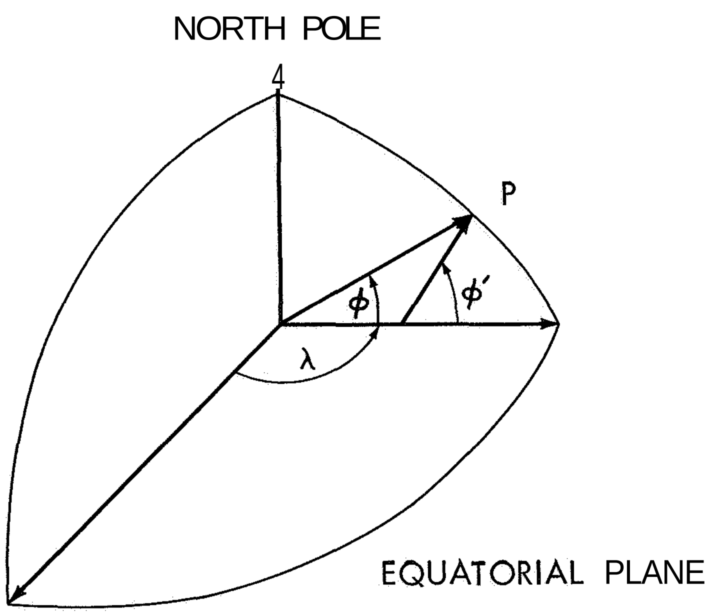
Geodetic Longitude and Latitude

This Earth-centered coordinate system locates points on the Earth's surface. The basic reference planes for this system are the Earth's equatorial plane, and the plane which passes through the Earth's poles and through Greenwich, England. Angles of longitude are measured along the equatorial plane from the Greenwich Prime Meridian to the great circle which passes through the Earth's poles and through the Earth surface point. Latitude (ϕ') is measured from the equatorial plane to the line perpendicular to the tangent plane at the Earth surface point, P. North latitude is positive, South latitude is negative ($-90° \leqq \phi' \leqq +90°$). East longitude is positive, West longitude is negative ($-180° \leqq \lambda \leqq +180°$).

ϕ = Geocentric Latitude

ϕ' = Geodetic Latitude

A = Geodetic Longitude = Geocentric Longitude



Geomagnetic Longitude, Latitude

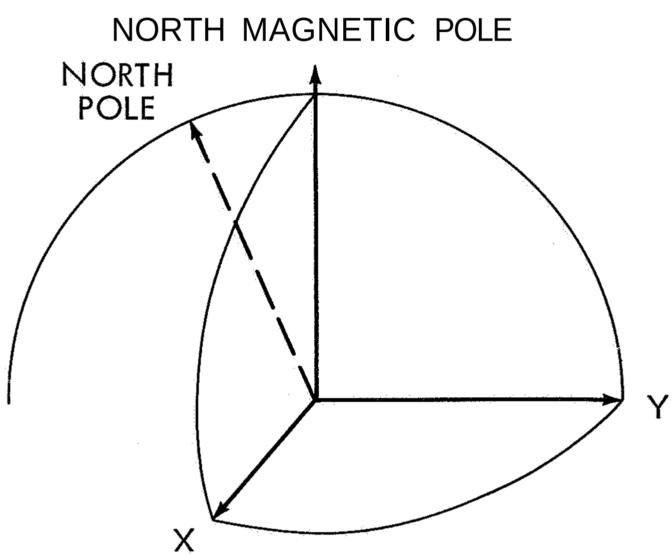
The origin for this coordinate system is the center of the Earth. The Z axis points to the North Magnetic Pole. The reference Magnetic North Pole position in geodetic coordinates as defined by the International Convention of **1922** is:

Longitude = **289.9'** East

Latitude = **78.6°** North

The magnetic **Y** axis is defined as the cross-product of the geodetic polar axis and the north magnetic polar axis. The X axis is defined as the cross-product of the Y axis and the **Z** axis. The X and Y axes then define the magnetic equatorial plane.

Longitude (λ) is measured along the magnetic equatorial plane from the X–Z plane to the great circle passing through the magnetic poles and the point to be located. Latitude (ϕ) is measured from the equatorial plane to the line from the center of the Earth to the point. North latitude is positive, South latitude is negative **(–90'** $\leqq \phi \leqq$ +90°). East longitude is positive, West longitude is negative (–180" $\leqq \lambda \leqq$ +180°).



4.3.6 Pseudo-Sequence Count and Satellite Clock

We will furnish each experimenter with a monotonically increasing pseudo-sequence count, and also an experiment cycle I. D. , and the satellite clock. The pseudo-sequence count is a seven-digit decimal number (21 binary bits) to uniquely identify each telemetry sequence for one year. It starts with 1 at the time of launch (i.e. , first recorded data), and continues counting by one for each sequence. For data gaps, the sequence count is automatically corrected using the frame times. In the cases of telemetered clock error, or power off-restart conditions, or of satellite clock resets, the time correction program continues updating the pseudo-sequence count by one.

In order that experiments synced to the satellite clock know their position with a cycle, the low-order five bits of this accumulator are furnished as an "experiment cycle I. D." (one BCD character) corrected if necessary and possible.

4.3.7 Sequence Identifiers for IMP-F Experimenter Tapes

Available on each IMP-F experimenter tape are three sequence identifiers which we have named (1) "pseudo-sequence count," (2) "satellite clock," and (3) "sequence I. D."

1. Pseudo-Sequence Count: We are attempting to uniquely identify each telemetered sequence during the life of the satellite with one assigned number, and this number is called the pseudo-sequence (P.S.) count. This count starts with the number 1 for the first sequence after launch, and the number is increased by 1 for each sequence thereafter. The telemetered "satellite clock," along with frame times, is the basis for determining the pseudo-sequence count. The time correction phase of the Decom program handles the pseudo-sequence count assignment, including fly-wheeling the count over data gaps, re-cycling of the satellite clock, or any abnormalities that occur to the satellite clock.

   (A) Pseudo-Sequence Count Quality Flags

   (1) The satellite clock which is telemetered in Frames 7 and 15 is used in conjunction with frame times to generate a pseudo-sequence count quality flag for each pseudo-sequence count.

   The pseudo-sequence count quality flags (3 bits binary, or 1 BCD character) are defined as follows:

BCD Tapes 1 BCD Character	Binary Tapes 3 Binary Bits	Definition
0	000	Both satellite clock values of the sequence were equal, and this value agreed with the predicted P. S. count.
1	001	There was noise present in one or both satellite clock readings, but the clock was reconstructable, and the reconstructed value agreed with the predicted value.
2	010	The two clock values in the sequence were too noisy to reconstruct. The P. S. count was generated from the predicted value.
3	011	There was noise present in one or both satellite clock values in the sequence, but the clock was reconstructable. However, when reconstructed it did not agree with the predicted value. The P. S. count was generated from the predicted value.
4	100	Both satellite clock values in the sequence are equal, but do not agree with the predicted value. The P. S. count was generated from the predicted value.
5	101	The two clock values in the sequence were too noisy to reconstruct, or after reconstruction did not agree with the predicted value. Due to uncorrectable frame time errors, a correct P. S. count could not be generated (The satellite clock value from Frame 7 is inserted as a pseudo-sequence count).
6	110	Both satellite clock readings in the sequence are equal, but they do not agree with the predicted value. Due to uncorrectable frame time errors a correct P. S. count could not be generated (The satellite clock value is inserted as a pseudo-sequence count).

(2) During A/D conversion, a 2-bit data quality flag is assigned to each 4-bit burst of data. The 16-bit satellite clock will have 4 flags associated with it. Of these 4 *flags,* the flag depicting the worst data quality will be supplied with the other 3-bit Pseudo-Sequence Count Quality Flag. The 2-bit data quality flags are defined as follows:

BCD Tapes 1 BCD Character	Binary Tapes 2 Binary Bits	Definition
3	11	Data Quality Good
2	10	Data Quality Fair
1	01	Data Quality Poor
0	00	Data Quality Undetermined

(3) The two sets of Sequence Clock Flags will be grouped as follows:

(a) Binary tapes (5 bits)

Pseudo-Sequence Count Flag - see item (A) **(1).**

$\underbrace{XX}\ \overbrace{XXX}$

Data Quality Flag - see item (A) **(2).**

(b) BCD Tapes **(2** BCD characters)

Pseudo-Sequence Count Flag - see item (A) **(1).**

CC

Data Quality Flag - see item **(A)** (2).

2. Satellite Clock: We are providing this number with final experimenter tapes primarily to facilitate cross reference with "quick-look" processed data. We have chosen the Frame 7 value of the telemetered satellite clock for that number identified on experimenter tapes as "satellite clock."

The satellite clock is a 16-bit accumulator in the spacecraft which is updated by one every telemetry sequence, so this clock will be recycling approximately every fifteen days. The state of this accumulator is telemetered twice each sequence, four bits at a time during Channels 14 and 15 of Frames 7 and 15. If noise is not present in the telemetered clock signal, the satellite clock value in Frame 7 should be identical to the satellite clock value in Frame 15 of any given sequence. The quality flags provided as "satellite clock quality flags" are the four 2-bit indices assigned during analog-to-digital conversion of channels 29, 30, 31, and 32 of Frame 7 (see Item (A) (2)).

3. Sequence I.D.: The low order bits of the telemetered sequence counter (satellite clock) are used by several experiments to determine the position within the sub-commutated experiment cycle. The data furnished as "sequence I.D." on experimenter tapes is: 1) the low-order bits from Frame 7, or Frame 15 satellite clock, whichever is "best" as indicated by the A/D conversion quality flag; or 2) a predicted sequence number which is generated when both satellite clocks are bad. The prediction is made from the number of the previous sequence and the frame times within the present sequence. Since the experiment cycles vary (8 sequences/cycle, 16 sequences/cycle, or 32 sequences/cycle) the number of bits provided each experimenter as "sequence I.D." also varies.

(A) Sequence I.D. Quality Flags

BCD Tapes 1 BCD Character	Binary Tapes (3 bits)	Definition
0	000	The quality flag for this burst from the A/D conversion indicates "good data."
1	001	The quality flag for this burst from the A/D conversion indicates "fair data."
2	010	The quality flag for this burst from the A/D conversion indicates "bad data," and a predicted value could not be established. The sequence I.D. bits are given as telemetered.
3	011	Data quality not established for this sequence I.D.

BCD Tapes 1 RCD Character	Binary Tapes (3 Bits)	Definition
4	100	This sequence I.D. is a predicted value because both sequence counters indicated "bad data."

(B) Time Quality Flags

Prior to the IMP-F telemetry data being unpacked and individual experimenter tapes being generated, the data is passed through the time-correction phase of the data processing system. This phase corrects €or minor time discrepancies and sequence counter errors. Tables are also generated to help in analyzing the more serious timing and sequencing errors. This is necessary in order to tag each telemetry sequence with an accurate time.

A flag will be used to indicate the quality of the time associated with each telemetry sequence. The time quality flags are defined as follows:

BCD Tapes 1 BCD Character	Binary Tapes (2 Binary Bits)	Definition
0	00	This frame time agrees within tolerance limits with the predicted frame time. No time correction was necessary.
1	01	This frame time exceeded tolerance limits from the predicted frame time. The time correction phase computed a time for this frame and this replaced the incorrect time.
2	10	This frame time exceeded tolerance limits from the predicted frame time. The time correction phase was unable to compute a correct time for this frame, so time was not changed.
3	11	The time correction phase was bypassed. The quality of the time for this frame was not computed.

Intermediate Data Tape Sequence Data Quality Flags

For each complete telemetry sequence, a flag is generated which indicates the probable quality of data within that sequence. This sequence data quality flag is within the 13th 6-bit character (counting 1, 2, ... , 13) on each data record of the intermediate data tape. The three (3) least significant bits of this 6-bit character are the sequence quality flag. This flag has previously been referred to as the "D table look-up index number."

The F9 program uses the computed signal-to-noise ratio to determine the probability of error per sequence. The sequence data quality flags on F9 digitized intermediate data tapes have these meanings:

	Flag	Data Quality
See page 11-7	0	Probability of one or more errors in each 100 samples, category 1.
See page 11-7	1	Probability of one or more errors in each 100 samples, category 2.
See page 11-7	2	Probability of one or more errors in each 100 samples, category 3.
	3	Probability of one or more errors in each 330 samples.
	4	Probability of one or more errors in each 500 samples.
	5	Probability of one or more errors in each 1000 samples
	6	(fill character) Data quality is undetermined for this partial sequence.

Data quality flags on a sequence basis are computed by the F8 processing program. From the number of errors in the satellite clock and in the sync oscillator, an assumption is made about the quality of the entire sequence. The F8 assigned sequence quality flags have these meanings:

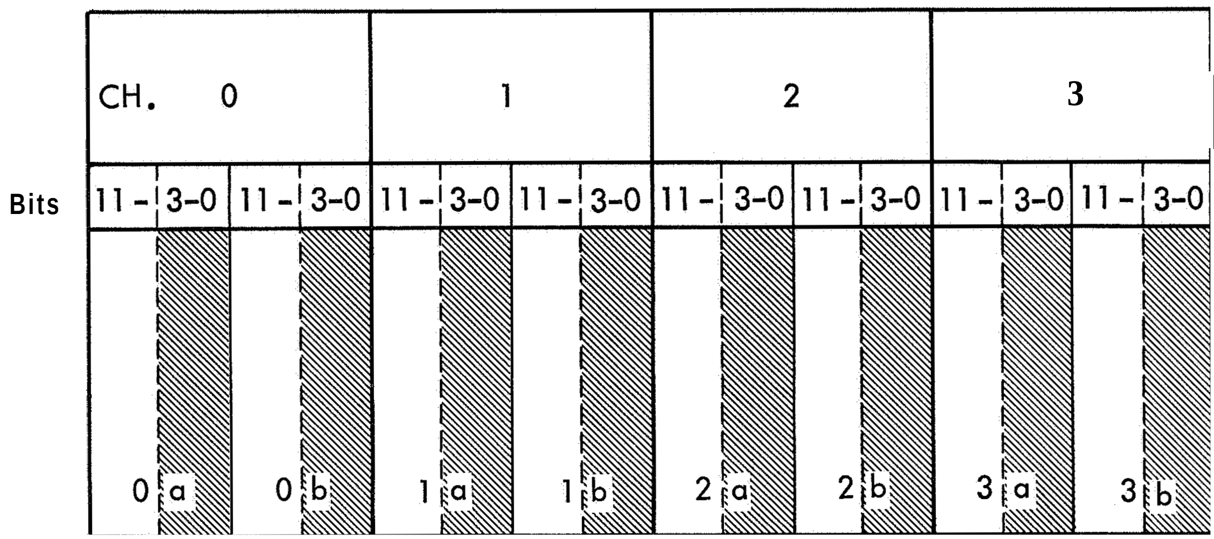
Flag	Data Quality
0	Undetermined
1	Poor quality
2	Fair quality
3	Good quality
7	Fill character, undetermined data quality

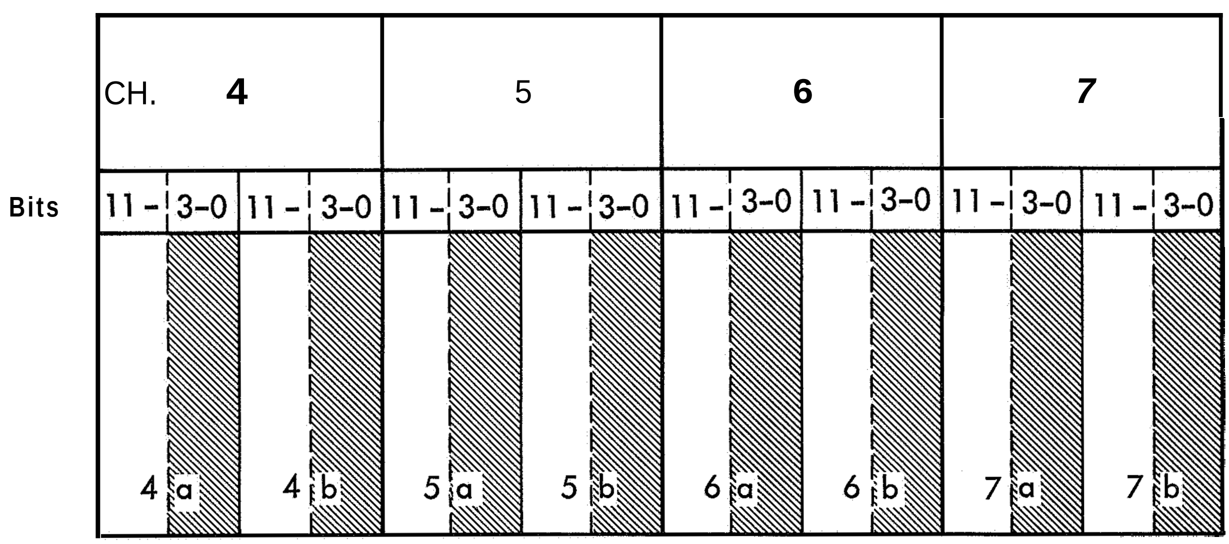
4.4 FORMATS FOR IMP-F ACCUMULATOR DATA

On the following pages are diagrams showing the method used for extracting telemetry data and forming data field accumulators for individual experiments.

TELEMETRY FORMAT

The following diagram is of one telemetry frame shown in **UNIVAC** 1108 format. Each frame contains 16 channels. Each channel contains two sections consisting of 12 binary bits each or a total of 24 bits per channel.





TELEMETRY FORMAT
(continued)

	CH. 8				9				10				11			
Bits	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0
	8	a	8	b	9	a	9	b	10	a	10	b	11	a	11	b

	CH. 12				13				14				15			
Bits	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0	11 -	3-0
	12	a	12	b	13	a	13	b	14	a	14	b	15	a	15	b

a

"S-T" TYPE ACCUMULATOR

16 Bit Accumulator =

15			0
5b 3 - 0	5a 3 - 0	4b 3 - 0	4a 3 - 0

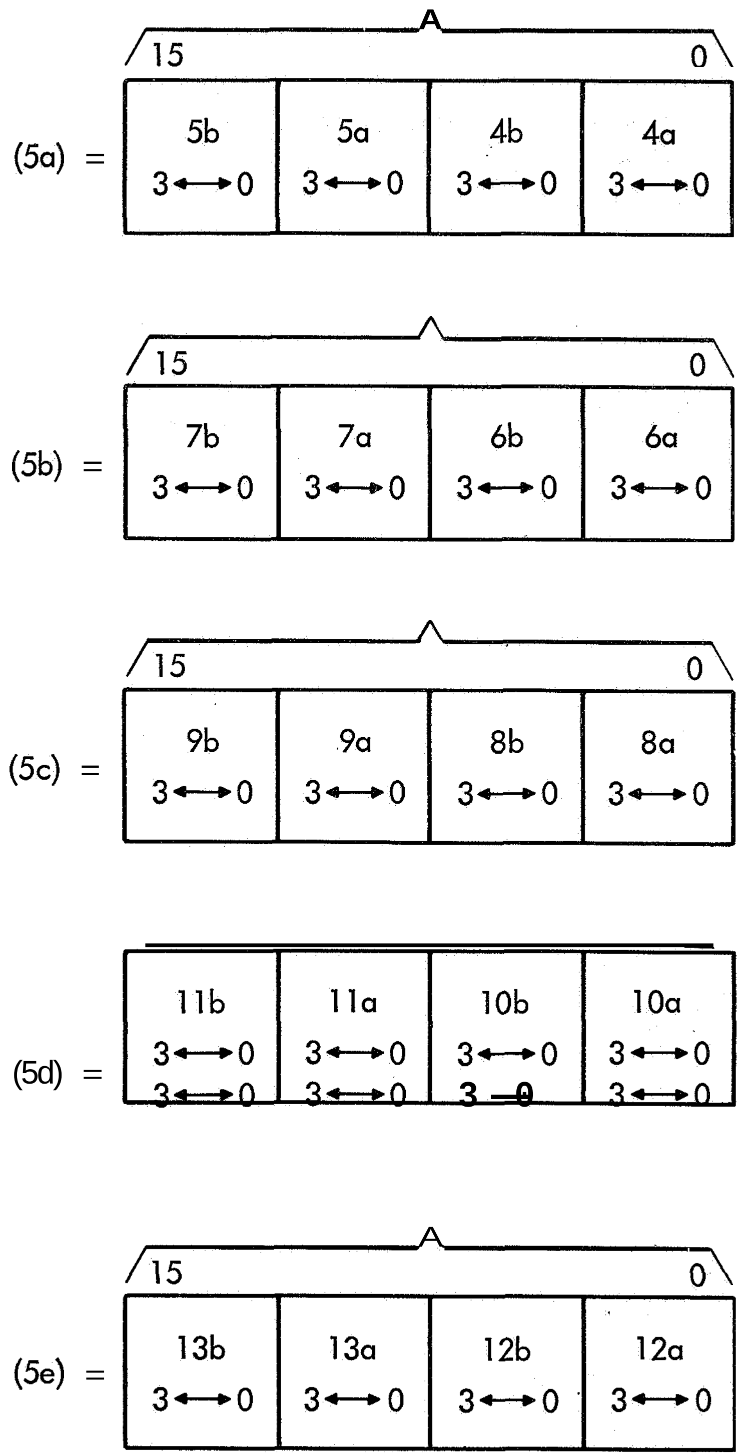
"S" TYPE ACCUMULATOR

16 Bit Accumulator =

15			0
5b 3 - 0	5a 3 - 0	4b 3 - 0	4a 3 - 0

15	0
0 ---	01

The BTL accumulators designated 5a, 5b, 5c, 5d, and 5e are taken from frames 7 and 15 channels 4 to **13** inclusive. 5a through 5e are 16 bit "S-T" Type Accumulators.



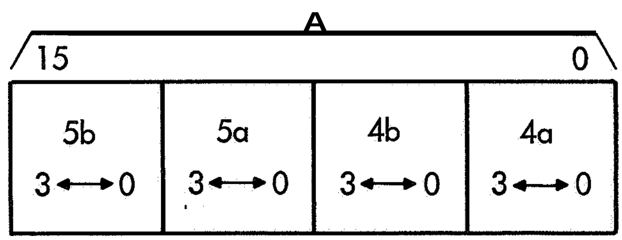
Data for this experiment consists of:

Two 16 bit **S-T** Type accumulators (3a, 3b) from frames 2 & 10:

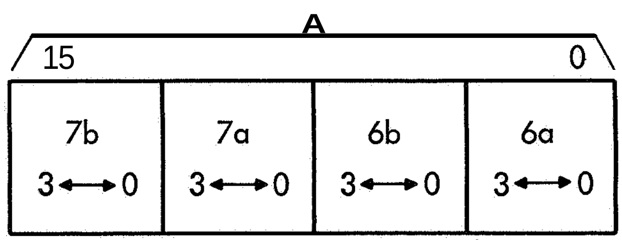
Two 16 bit **S** Type accumulators (3c, 3d) from frames 6 & 14: and one 2–count jammer 3e from frames 6 & 14.

Their formats:

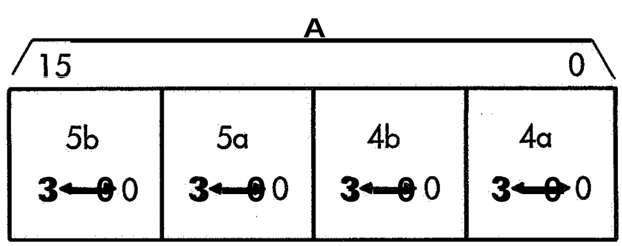
(3a) =

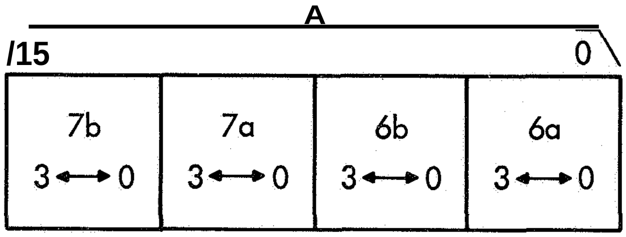


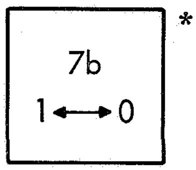
(3b) =



(3c) =



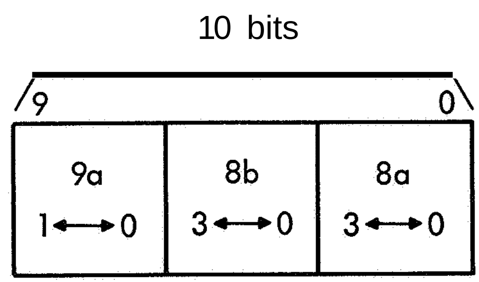
(3d) = 

(3e) = 

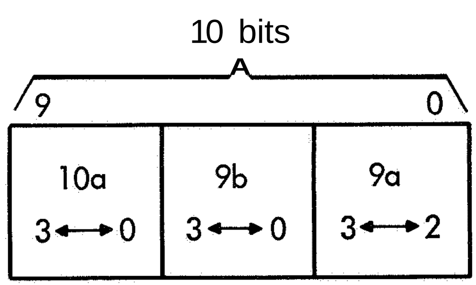
*The final value of a two count jammer is arrived at by performing an "oc" function on the raw data with an octal 3.

University of Chicago experimental data is found in frames 2, **6,** 10, & **14.** In each of these frames, channels 8–15 are found, in order, two 10 bit accumulators, one 12 bit accumulator, and three 8 bit accumulators. All accumulators are S–T type and are labeled 7a, 7b, 7c, Chi Scan **1,** Chi Scan 2, and Chi Scan **3** respectively. Their formats are:

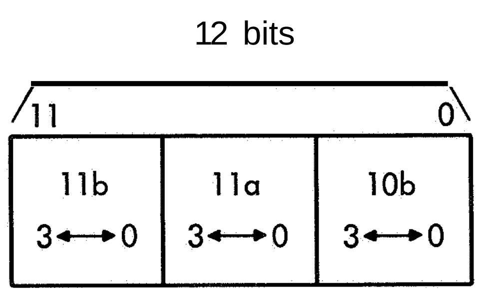
(7a) =

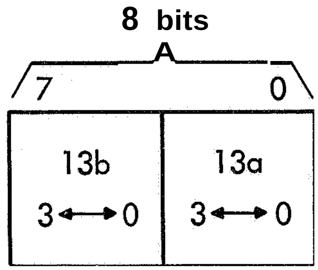


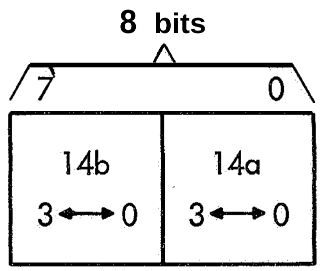
(7b) =

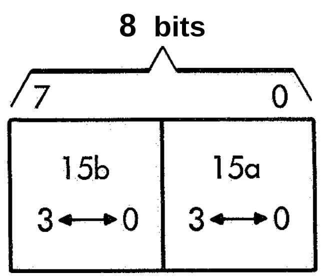


(7c) =



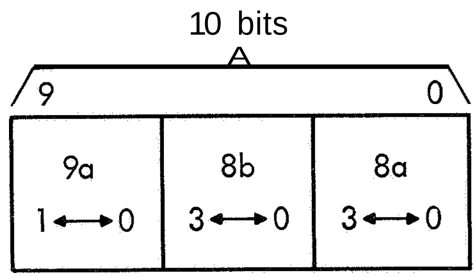
(Chi Scan 1) = 

(Chi Scan 2) = 

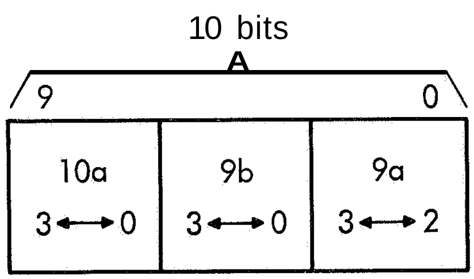
(Chi Scan 3) = 

The data for this experiment is found in 10 bit S Type accumulators (6a, 6b, 6c, 6d) followed by a 24 bit S Type accumulator (6e). They are located in channels 8–15 in each of four frames (1, 5, 9, & 13). Their formats are:

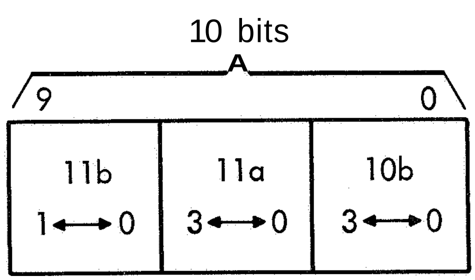
(6a) =



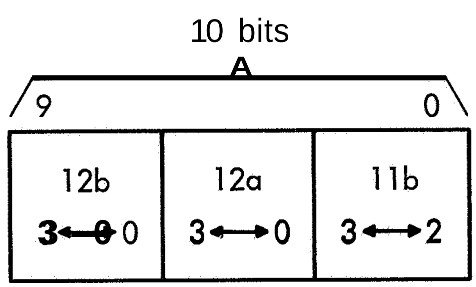
(6b) =



(6c) =



(6d) =

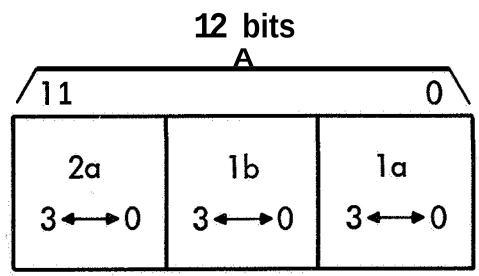


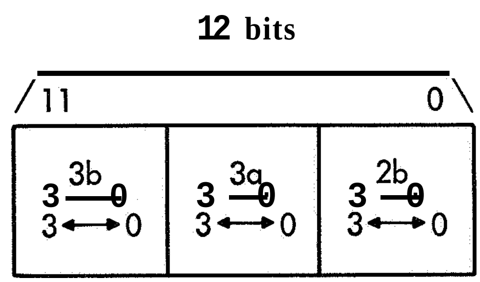
24 bits

(6e) =

23					0
15b	15a	14b	14a	13b	13a
$3 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$

The data for this experiment is found in two 12 bit S–T Type accumulators in each of 4 frames (2, **6,** 10, & 14). Their format is:

(1a) = 

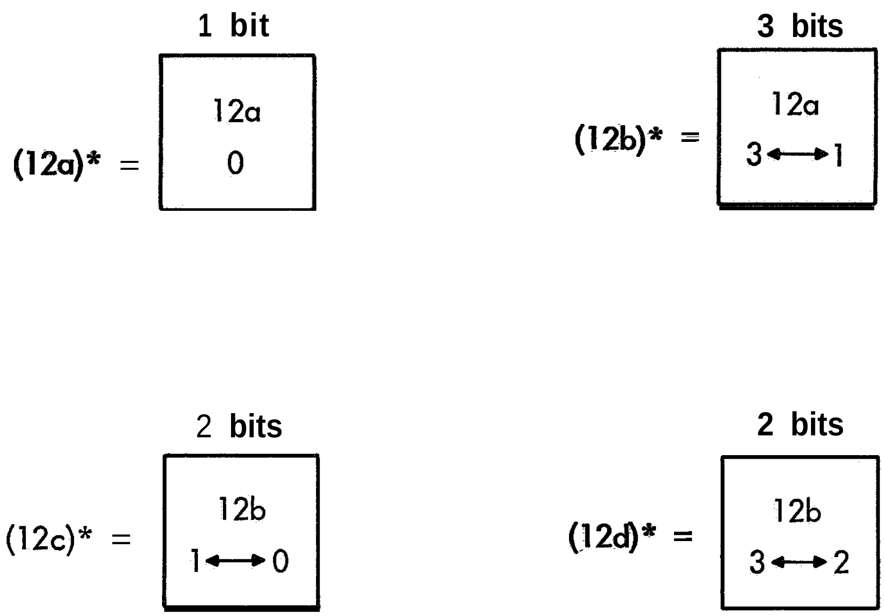
(1b) = 

The experimental data for the University of Maryland is located in frame 0, channels 1–13 inclusive.

Channels 1 through 11 and channel 13 are 4 bit S–T Type accumulators having the following format:

Same for Channel 2a	Same for Channel 2b
Same for Channel 3a	Same for Channel 3b
Same for Channel 4a	Same for Channel 4b
Same for Channel 5a	Same for Channel 5b
Same for Channel 6a	Same for Channel 6b
Same for Channel 7a	Same for Channel 7b
Same for Channel 8a	Same for Channel 8b
Same for Channel 9a	Same for Channel 9b
Same for Channel 10a	Same for Channel 10b
Same for Channel 11a	Same for Channel 11b
Same for Channel 13a	Same for Channel 13b

Channel **12** is divided into one **3** bit, one **1** bit, and two 2 bit accumulators having the following formats:



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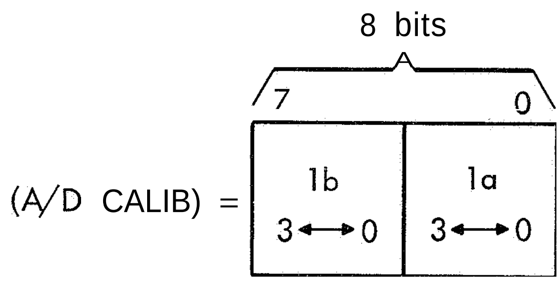
*Accumulator labels in parenthesis should not be confused with channel labels listed in the diagrams.

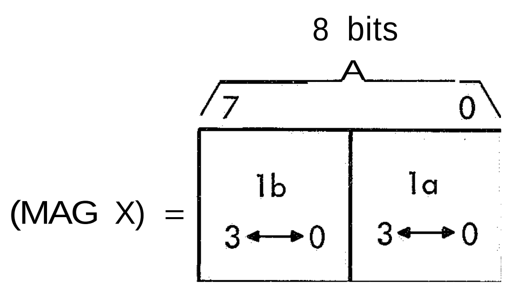
DR. NESS

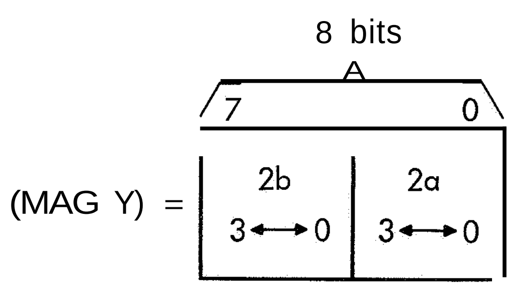
Data from this experiment is obtained in the following manner and locations:

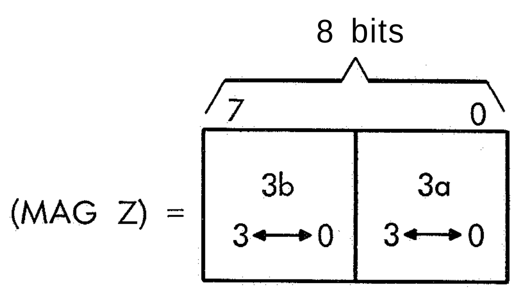
A/D CALIB is an 8 bit S-T Type accumulator located in channel 1 of frame 4. Its format is:



MAG X, MAG Y, & MAG Z are three 8 bit S-T Type accumulators located in channels 1, 2, & 3 respectively of frames 1, 3, 5, 7, 9, 11, 13, & 15. Their formats are:

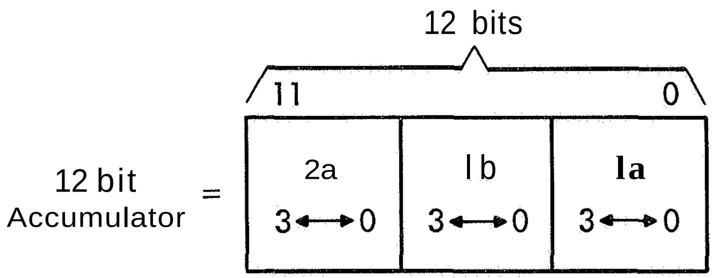


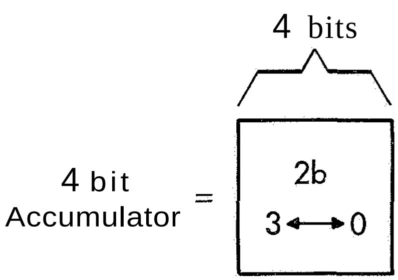


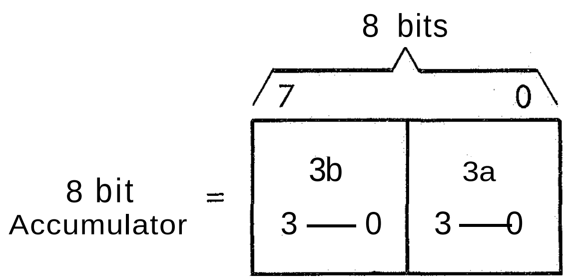


FLUX GATE DIGITAL SCAN occupies channels 1–15 of frame 8.

It has an initial 12 bit S–T Type accumulator followed by alternating 4 bit and 8 bit S–T Type accumulators grouped as follows:







Same for Channel 2b — Same for Channels 5a & 4b

Same for Channel 4a — Same for Channels 6b & 6a

Same for Channel 5b — Same for Channels 8a & 7b

Same for Channel 7a — Same for Channels 9b & 9a

Same for Channel 8b — Same for Channels 11a & 10b

Same for Channel 10a — Same for Channels 12b & 12a

Same for Channel 11b — Same for Channels 14a & 13b

Same for Channel 13a — Same for Channels 15b & 15a

Same for Channel 14b

SOUTHWEST CENTER FOR ADVANCED STUDIES (SCAS)

The SCAS accumulators are designated 4a, 4b, 4c, . . . 4j and are found in frame **3** and again in frame **11**. They are in a sequence of nine 10 bit **S-T** Type accumulators with a final (60^{th}) 6 bit S–Type accumulator (4j) for a total of 96 bits each in frames **3** and **11**. The data is found in channels 4–15 in both frames. Their fcrmats **are:**

(4a) = 10 bits (9 … 0)

5a	4b	4a
2 ↔ 0	3 ↔ 0	3 ↔ 0

(4b) = 10 bits (9 … 0)

6a	5b	5a
3 ↔ 0	3 ↔ 0	3 ↔ 0

(4c) = 10 bits (9 … 0)

7b	7a	6b
1 ↔ 0	3 ↔ 0	3 ↔ 0

(4d) = 10 bits

8b	8a	7b
3 ↔ 0	3 ↔ 0	3 ↔ 2
~~3 ↔ 0~~	~~3 ↔ 0~~	~~3 — 2~~

(4e) = 10 bits (9 … 0)

10a	9b	9a
1 ↔ 0	3 ↔ 0	3 ↔ 0

(4f) = 10 bits (9 … 0)

11a	10b	10a
3 ↔ 0	3 ↔ 0	3 ↔ 2

10 bits (9 … 0)

(4g) =

12b	12a	11b
$1 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$

10 bits

(4h) =

$3 - 0$	$3 - 0$	$3 \leftrightarrow 2$

10 bits (9 … 0)

(4i) =

15a	14b	14a
$2 \leftrightarrow 0$	$3 \leftrightarrow 0$	$3 \leftrightarrow 0$

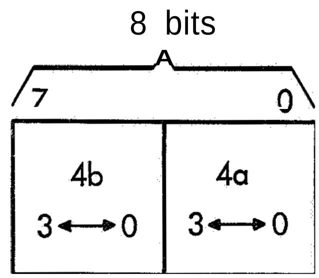
***6* bits** (5 … 0)

(4j) =

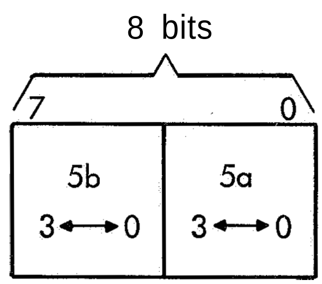
15b	15a
$3 \leftrightarrow 0$	$3 \leftrightarrow 2$

The experimental data for this experiment is located in channels **4-7** of frames **1, 5, 9, & 13.** They form 8 bit S–T Type accumulators with the following formats:

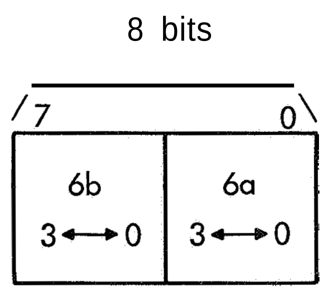
(TRW 1) =



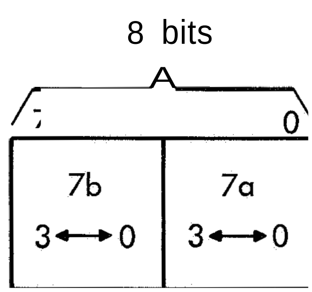
(TRW 2) =



(TRW 3) =



(TRW 4) =



4.5 EXPERIMENTER TAPE FORMATS

The experimenter tape formats are listed in the following sub-paragraphs:

4.5.1 Bell Telephone Tape

4.5.2 University of California Tape

4.5.3 University of Chicago Tapes

4.5.4 State University of Iowa Tape

4.5.5 Southwest Center for Advanced Studies (SCAS) Tapes

4.5.6 TRW Tapes

4.5.7 APL/GSFC Tape

4.5.8 GSFC - University of Maryland Tape

4.5.9 GSFC - Dr. Hagge's Tape

4.5.10 Optical Aspect and Performance Parameter Tape

4.5.11 Dr. Ness - Magnetic Field Tape

4.5.12 Radiation Damage Tape

4.5.1 Bell Telephone (BTL) Experimenter Tape Format

Experimenter I. D. : 01 5/9/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Control Word	
2	0-8	Days	Day of Frame 0, Channel 0	I
2	9-35	ms.	Milliseconds of Frame 0, Channel 0	I
3	0-1		Time Quality	
3	2-6		Pseudo-Sequence Count Quality Flag	
3	7-27	Counts	Pseudo-Sequence Count	
3	28-30		Sequence I. D. Quality	
3	31-35	Counts	Sequence I. D.	
4	12-19		Satellite Clock Quality Flags (Channels 14a, 14b, 15a, 15b)	I
4	20-35	Counts	Satellite Clock	I
5	0-1		Frame 7, 5a Quality Flag	I
5	2-17	counts	Frame 7, 5b	I
5	18-19		Frame 7, 5b Quality Flag	I
5	20-35	Counts	Frame 7, 5b	I
6	0-1		Frame 7, 5c Quality Flag	I
6	2-17	Counts	Frame 7, 5c	
6	18-19		Frame 7, 5d Quality Flag	I
6	20-35	counts	Frame 7, 5d	
7	0-1		Frame 7, 5e Quality Flag	I
7	2-17	Counts	Frame 7, 5e	I
7	18-19		Frame 15, 5a Quality Flag	
7	20-35	counts	Frame 15, 5a	
8	0-1		Frame 15, 5b Quality Flag	I

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
8	2-17	Counts	Frame 15, 5b	I
8	18-19		Frame 15, 5c Quality Flag	I
8	20-35	Counts	Frame 15, 5c	I
9	0-1		Frame 15, 5d Quality Flag	I
9	2-17	counts	Frame 15, 5d	I
9	18-19		Frame 15, 5e Quality Flag	I
9	20-35	Counts	Frame 15, 5e	I
10	36	Degrees	Optical Aspect (Spin Axis Sun Angle)	I
11	0-17	msecs	Optical Aspect 1 (Sun Time)	I
11	18-35	msecs	Optical Aspect 2 (Spin Period)	I
12	0-17	msecs	Optical Aspect 3 (Earth Horizon Time)	I
12	18-35	msecs	Optical Aspect 4 (Earth Width)	I
13	0-17	Volts	PP7	I
13	18-35	Volts	PP8	I
14	0-17	Volts	PP9	I
14	18-35	Degrees	PP17, PP25, (PP17 on even sequences, PP25 on odd)	I
15-209			Data from 15 more telemetry sequences (items 2-14 repeated 15 times)	
210	36	Days	Time of Orbit Data, Day	I
211	36	msecs	Time of Orbit Data Milliseconds of Day	I
212	36	Degrees	Longitude, satellite position in geocentric coordinates	F
213	36	Degrees	Latitude, satellite position in geocentric coordinates	F

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
214	36	Kms.	Radial distance, center of earth to the satellite	F
215	36	Kms.	X solar ecliptic satellite position	F
216	36	Kms.	Y solar ecliptic satellite position	F
217	36	Kms.	Z solar ecliptic satellite position	F
218	36	Kms.	Solar Magnetosphere X satellite Position (E. R.)	F
219	36	Kms.	Solar Magnetosphere Y satellite position (E. R.)	F
220	36	Kms.	Solar Magnetosphere Z satellite position (E. R.)	F
221	36	Kms.	Solar Ecliptic X moon position (E. R.)	F
222	36	Kms.	Solar Ecliptic Y moon position (E. R.)	F
223	36	Kms.	Solar Ecliptic Z moon position (E. R.)	F
224	36	earth radius	L-McIlwain Param., real field coord.	F
225	36	Gauss	B-Field Strength, real field coordinate system	F
226	36	Degrees	Satellite-Earth-Sun-Angle (L_{SEP})	F
227	36	Degrees	Right Ascension of the Magnetic Vector	F
228	36	Degrees	Declination of the Magnetic Vector	F
229	36	Kms.	Celestial Inertial X satellite position	F
230	36	Kms.	Celestial Inertial Y satellite position	F
231	36	Kms.	Celestial Inertial Z satellite position	
232 to 297			Orbit data items (209-230) repeated 3 more times	
298			Zero filler	

This is a seven-track, 800 BPI, binary mode tape. The bits column refers to an IBM 7094 36-bit word with the bits numbered from left to right, 0 to 35. The last word of each record is a filler word of all zeros.

Optical aspect data is fixed point. OA Scan will have 5 bits to the right of the binary point, all other OA's are integers. The performance parameters are fixed point with 5 bits to the right and 12 bits to the left of the assumed binary point. Bits 0 and 18 are sign bits on the performance parameters. Orbit data is floating point format. Set all bits (including sign bit) for missing data. End of orbit is indicated by setting all the words in a record equal to 9999999999_{10} (or 112402761777_8) which will be followed by an end-of-file mark.

Missing data may occur in one frame of data of a sequence, but not in any other frames of the same sequence. In this case, all bits will be on only for the data associated with the frame losing synchronization.

4.5.2 University of California Experimenter Tape Format

Experimenter I. D. : 02 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1		Days	Day of frame 0, channel 0	I3
2		msec	Milliseconds of frame 0, channel 0	I8
3			Time quality flag	I1
4		Counts	Pseudo-sequence count	I7
5			Pseudo-sequence count quality flag	I2
6			Sequence clock odd/even flag	I1 (0=even) (1=odd)
7			Satellite clock	I5
8			UCAL on/off flag, 1="on"	I1
9		counts	PP7 +11.7 volts (raw data)	I3
10		Volts	PP7 +11.7 volts (calibrated volts X 100)	I5(±XX.XX)
11		counts	PP13 battery temp, even numbered sequences (raw data), PP25 skin 1 temp, odd numbered sequences (raw data)	I3
12		Degrees	PP13 or PP25 (calibrated X 100)	I5(±XX.XX)
13		counts	PP18 UCAL temp, even numbered sequences (raw data). PP26 skin 2 temp, odd numbered sequences (raw data)	I3
14		Degrees or Volts	PP18 or PP26 (calibrated X 100)	I5(±XX.XX)
15		counts	PP19 U of Chicago temp, even numbered sequences, PP27 (+7 volts) odd numbered sequences (raw data)	I3
16		Degrees	PP19 or PP27 (calibrated X 100)	I5(±XX.XX)
17			Frame 2, 3a data quality flag	I1
18		counts	Frame 2, 3a	I5
19			Frame 2, 3b data quality flag	I1
20		counts	Frame 2, 3b	I5

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
21			Frame 6, 3c data quality flag	I1
22		counts	Frame 6, 3c	I5
23			Frame 6, 3d data quality flag	I1
24		counts	Frame 6, 3d	I5
25			Frame 6, 3e data quality flag	I1
26		counts	Frame 6, 3e	I1
27			Frame 10, 3a data quality flag	I1
28		counts	Frame 10, 3a	I5
29			Frame 10, 3b data quality flag	I1
30		counts	Frame 10, 3b	I5
31			Frame 14, 3c data quality flag	I1
32		counts	Frame 14, 3c	I5
33			Frame 14, 3d data quality flag	I1
34		counts	Frame 14, 3d	I5
35			Frame 14, 3e data quality flag	I1
36		counts	Frame 14, 3e	I1
37		Degrees	Optical aspect scan (spin axis-sun angle X 100)	I5(±XX. XX)
38		msecs	Optical aspect 1 (sun time)	I4
39		msecs	Optical aspect 2 (spin period)	I5
40		msecs	Optical aspect 3 (earth time)	I5
41		msecs	Optical aspect 4 (earth width)	I4
42-164			Data from three more sequences (items 1-41 repeated 3 times)	
165		Days	Day of orbit data	I3

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
166		msecs	Milliseconds of day of orbit data	I8
167		Degrees	Geocentric longitude $-180^\circ \le \theta \le +180^\circ$	F8.3
168		Degrees	Geocentric latitude $-90^\circ \le \theta \le +90^\circ$	F7.3
169		Degrees	Geomagnetic latitude $-90^\circ \le \theta \le +90^\circ$	F7.3
170		Degrees	Geomagnetic longitude $-180^\circ \le \theta \le +180^\circ$	F8.3
171		Kilometers	Distance from the center of the earth	F10.3
172		Earth Radii	X Solar ecliptic coordinate	F10.6
173		Earth Radii	Y Solar ecliptic coordinate	F10.6
174		Earth Radii	Z Solar ecliptic coordinate	F10.6
175		Earth Radii	X Solar magnetosphere coordinate	F10.6
176		Earth Radii	Y Solar magnetosphere coordinate	F10.6
177		Earth Radii	Z Solar magnetosphere coordinate	F10.6
178		Gamma	X Theoretical geomagnetic field (GSE)	F10.6
179		Gamma	Y Theoretical geomagnetic field (GSE)	F10.6
180		Gamma	Z Theoretical geomagnetic field (GSE)	F10.6
181		Gamma	B = Magnitude Theoretical Geomagnetic field	F10.4
182		Degrees	Right ascension (satellite position)	F7.3
183		Degrees	Declination (satellite position)	F7.3
184		Degrees	Right Ascension (velocity vector)	F7.3
185		Degrees	Declination (velocity vector)	F7.3
186		Meters/sec	Magnitude of the velocity	F9.3
187		Earth Radii	L-McIlwain magnetic shell radius	F10.6
188		Degrees	L_{SEP} Satellite-earth-sun angle	F7.3

This tape is a 7-track, 556 BPI, BCD tape. The BCD is standard 6-bit external code. Missing data will be indicated by 9's throughout the field.

GSE - these X, Y, Z coordinates are in the Geocentric Solar Ecliptic coordinate system.

The following FORMAT statement was used to write this data.

1. FORMAT(4(I3,I8,I1,I7,I2,I1,I5,I1,4(I3,I5),4(I1,I5)/2I1,4(I1,I5)12I1,I5,I4, 2I5,I4/)I3,I8,F8.3,2F7.3,F8.3, F10.3,6F10.6/4F10.6,4F7.3,1F9.3, F10.6, F7.3)

4.5.3 University of Chicago Experimenter Tape Format

Experimenter I.D.: 03 5/9/67

The IMP-F experimenter tapes for the University of Chicago will be recorded in 7-track binary mode at 556 BPI. A tape will consist of a variable number of data files, each of which will contain an ID record, some number of data records, and an end-of-file, in that order. A tape will be terminated by two additional ends-of-file following the last data file.

4.5.3 University of Chicago Experimenter Tape Format

ID Record - Experimenter I. D. : 03 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Experiment ID	I
2			Satellite ID	I
3			Orbit Number	I
4			Telemetry Recording Station Number	I
5			Analog Tape Number	I
6			Analog-to-digital Line ID	I
7			Day of Year (Start time for this file)	I
8			Milliseconds of Day (Start time for this file)	D
9			Day of Year (Stop time for this file)	I
10			Milliseconds of Day (Stop time for this file)	D
11			Average Sequence Time (Milliseconds) for this file	I
12			Quick Look Data Flag	I
13			Orbit/No Orbit Data Flag	I
14			Decom Process Date Year	I
15			Decom Process Date Month	I
16			Decom Process Date Day	I
17			Decom Process Date Hour	I
18			Orbit Tape ID Reel Number	I
19			Orbit Tape Date of Generation Year	I
20			Orbit Tape Date of Generation Month	I
21			Orbit Tape Date of Generation Day	I
22			Average Spin Period in Milliseconds	I
23			Year of Start Time for this file	I

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
24			Year of Stop Time for this file	
25-40			Room for Expansion)	I)

FORMATS

Code	Bits	Description
I	24	A SDS 930 fixed point word, with assumed binary point at the extreme right.
D	48	A double-length integer. The first 24-bit SDS 930 word contains the high-order 24 bits, the first of which (bit 0 of the SDS 930 word) is the sign of the entire item. The second 24-bit SDS 930 word contains the low-order 24 bits, the high-order bit of which is considered to be a magnitude bit, not the sign. The assumed binary point is at the extreme right of the second word.*

NOTES

1. Each ID record will contain 42 SDS 930 24-bit words. ("D" format items require two 24-bit words.)

2. All years indicated will be given as binary integers representing the last two digits of the Gregorian year.

3. The telemetry recording station numbers will be coded as: Numbers 00-99 as indicated in the Stadan Number-Name Table which is attached.

4. The analog-to-digital line ID will be coded as:

   1 = F9 line
   2 = F8 line

5. The satellite ID will be coded as: IMP-F = 13_{10}.

---

*Note that this is not standard SDS 930 double-precision fixed point format (in which the order of the two words would be reversed).

4.5.3 University of Chicago Experimenter Tape Format
Data Record - Experimenter I. D. : 03 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1	0-11		Time Quality	A
1	12-23	Days	Day of Frame 0, Channel 0	J
2		Hours	Hours of Frame 0, Channel 0	I
3		msecs	Milliseconds of Fractional Hour of Frame 0, Channel 0	
4		msecs	Average Sequence Time in Milliseconds	I
5			Pseudo-Sequence Count	I
6			Pseudo-Sequence Count Quality	B
7	0-1		Sequence ID Quality	C
7	12-23	Counts	Sequence ID	K
8	0-1		Data Quality Frame 7, Channel 14a	D
8	2-3		Data Quality Frame 7, Channel 14b	D
8	4-5		Data Quality Frame 7, Channel 15a	D
8	6-7		Data Quality Frame 7, Channel 15b	D
8	8-23		Satellite Clock, Frame 7 (Channels 14, 15)	L
9	0-11		Data Quality 7a, Frame 2	E
9	12-23	counts	Frame 2, 7a	J
10	0-11		Data Quality 7b, Frame 2	E
10	12-23	counts	Frame 2, 7b	J
11	0-11		Data Quality 7c, Frame 2	E
11	12-23	counts	Frame 2, 7c	J
12	0-11		Data Quality Frame 2, Channel 12a	D
12	12-23		Data Quality Frame 2, Channel 12b	D

TEM #	BITS	UNITS	IDENTIFICATION	FORMAT
13	0-11	counts	Frame 2, Channel 12, Bits 0-2	J
13	12-23	counts	Frame 2, Channel 12, Bits 3-4	J
14	all	Counts	Frame 2, Channel 12, Bits 5-7	I
15	0-11		Data Quality Frame 2, Channel 13	E
15	12-23	counts	Frame 2, Channel 13	J
16	0-11		Data Quality Frame 2, Channel 14	E
16	12-23	counts	Frame 2, Channel 14	J
17	0-11		Data Quality Frame 2, Channel 15	E
17	12-23	Counts	Frame 2, Channel 15	J
18	0-11		Data Quality 7a, Frame 6	E
18	12-23	counts	Frame 6, 7a	J
19	0-11		Data Quality 7b, Frame 6	E
19	12-23	counts	Frame 6, 7b	J
20	0-11		Data Quality 7c, Frame 6	E
20	12-23	counts	Frame 6, 7c	J
21	0-11		Data Quality Frame 6, Channel 12a	D
21	12-23		Data Quality Frame 6, Channel 12b	D
22	0-11	counts	Frame 6, Channel 12, Bits 0-2	J
22	12-23	counts	Frame 6, Channel 12, Bits 3-4	J
23	all	counts	Frame 6, Channel 12, Bits 5-7	I
24	0-11		Data Quality Frame 6, Channel 13	E
24	12-23	counts	Frame 6, Channel 13	J
25	0-11		Data Quality Frame 6, Channel 14	E
25	12-23	counts	Frame 6, Channel 14	J

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
26	0-11		Data Quality Frame 6, Channel 15	E
26	12-23	counts	Frame 6, Channel 15	J
27	0-11		Data Quality 7a, Frame 10	E
27	12-23	counts	Frame 10, 7a	J
28	0-11		Data Quality 7b, Frame 10	E
28	12-23	counts	Frame 10, 7b	J
29	0-11		Data Quality 7c, Frame 10	E
29	12-23	Counts	Frame 10, 7c	J
30	0-11		Data Quality Frame 10, Channel 12a	D
30	12-23		Data Quality Frame 10, Channel 12b	D
31	0-11	counts	Frame 10, Channel 12, Bits 0-2	J
31	12-23	counts	Frame 10, Channel 12, Bits 3-4	J
32	all		Frame 10, Channel 12, Bits 5-7	I
33	0-11		Data Quality Frame 10, Channel 13	E
33	12-23		Frame 10, Channel 13	J
34	0-11		Data Quality Frame 10, Channel 14	E
34	12-23	counts	Frame 10, Channel 14	J
35	0-11		Data Quality Frame 10, Channel 15	E
35	12-23	counts	Frame 10, Channel 15	J
36	0-11		Data Quality ?a, Frame 14	E
36	12-23	counts	Frame 14, 7a	J
37	0-11		Data Quality 7b, Frame 14	E
37	12-23	counts	Frame 14, 7b	J
38	0-11		Data Quality 7c, Frame 14	E

TEM #	BITS	UNITS	IDENTIFICATION	FORMAT
38	12-23	counts	Frame 14, 7c	J
39	0-11		Data Quality Frame 14, Channel 12a	D
39	12-23		Data Quality Frame 14, Channel 12b	D
40	0-11	counts	Fram 14, Channel 12, Bits 0–2	J
40	12-23	counts	Frame 14, Channel 12, Bits 3-4	J
41	all		Frame 14, Channel 12, Bits 5-7	I
42	0-11		Data Quality Frame 14, Channel 13	E
42	12-23	counts	Frame 14, Channel 13	J
43	0-11		Data Quality Frame 14, Channel 14	E
43	12-23	Counts	Frame 14, Channel 14	J
44	0-11		Data Quality Frame 14. Channel 15	E
44	12-23	counts	Frame 14, Channel 15	J
45	0-1		Data Quality Frame 4, Channel 2a	D
45	2-3		Data Quality Frame 4, Channel 2b	D
45	4-5		Data Quality Frame 4, Channel 3a	D
45	6-7		Data Quality Frame 4, Channel 3b	D
45	8-23	counts	Frame 4, Channel 2-3 (Encoder Flags)	G
46		Volts	PP8 (+28v)	R
47		Volts	PP12 (Univ. Chi. Volts)	R
48		Degrees	PP19 (Univ. Chi. Temp.) (Absent from every other record))	S
49		Degrees	Optical Aspect Scan (Spin Axis Sun Angle)	T
50		msecs	Optical Aspect 1 (Sun time)	I
51		msecs	Optical Aspect 2 (Spin period)	I

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
52		msecs	Optical Aspect 3 (Earth Time)	I
53		msecs	Optical Aspect 4 (Earth width)	I
54-57			Spares	(I)
58-114			Same as words 1-57 for a second sequence	
115-171			Same as words 1-57 for a third sequence	
172	0-11	Hours	Day of Orbit Data	J
172	12-23	msecs	Hours of Day of Orbit Data	J
173			Milliseconds of Fractional Hour of Orbit Data	I
174		Degrees	Geocentric Longitude $(-180^\circ \le \theta \le +180^\circ)$	F
175		Degrees	Geocentric Latitude $(-90^\circ \le \theta \le +90^\circ)$	F
176		Degrees	Geomagnetic Longitude $(-180^\circ \le \theta \le +180^\circ)$	F
177		Degrees	Geomagnetic Latitude $(-90^\circ \le \theta \le +90^\circ)$	F
178		Km	Distance from the center of the earth	F
179		Km	X	F
180		Km	Satellite Position in Solar Ecliptic Coordinates	F
181		Km	Z	F
182		Km	Y } Satellite Position in Solar Magnetospheric Coordinates	F
183		Km	Z	F
184		Degrees	Longitude } Sub-Solar Point in Geomagnetic Coordinates	F
185		Degrees	Latitude	

TEM #	BITS	UNITS	IDENTIFICATION	FORMAT
186		Degrees	Longitude } Sub-solar Point in Geo-	F
187		Degrees	Latitude } centric Coordinates	F
188			X }	F
139			Theoretical Geomagnetic Field in Solar Ecliptic Coordinates	F
190			Z }	F
191			spare (zero fill)	F
192		Km/Sec	Magnitude of the Velocity Vector	F
193		Earth Radii	L = Mc Ilwain Parameter	F
194		Gauss	B = Field Strength	F
195			B/B_o (Real Field Coordinate System)	F
196		Degrees	Satellite-Earth-Sun Angle	F
197-199			Spares	(I)

FORMATS

Code	Bits	Name	Description
A	2	Time Quality	
B	24	Pseudo-Sequence Count Quality	
C	3	Sequence ID Quality	
D	2	Data Quality (Single Data Burst)	The two bit data quality flag associated with the 4-bit burst of data.
E	2	Data Quality (Multiple Data Burst)	The flag depicting the worst data quality of the data quality flags associated with the data.
F	48	Floating Point Item	An SDS 930 single precision floating point number. This requires two 24-bit SDS 930 words.
G	16	Encoder Flags	See page IV-69.
I	24	Integer	An SDS 930 fixed point word, with assumed binary point at the extreme right.
J	12	Half-word Integer	An unsigned (positive) binary integer.
K	5	Sequence ID	
L	16	Satellite Clock	An unsigned (positive) binary integer.
R	24	Voltage (PP8,12)	An SDS 930 fixed point word, with binary point 5 places to left of least significant bit.
S	24	Temperature (PP19)	An SDS 930 fixed point word, with binary point 5 bits to left of least significant bit.

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Code	Bits	Name	Description
T	24	Optical Aspect Scan	

If the number of bits in the item is less than the field provided the item is right adjusted in the field.

NOTES

1. Each data record will contain 222 SDS 930 24-bit words. ("F" format items require two 24-bit words.)

2. Missing data will be filled with 37777777_8 in each 24-bit word.

3. Three sequences must be successive to occur in one record. If three successive sequences are not available, fill words will be inserted for the missing ones.

4. There will be no synchronization governing which sequence occupies a given position in a record. The first available sequence will be in the first position, etc.

5. The time of the orbit data in a given record will be approximately the time of Channel 0, Frame 0, of the first sequence in the record.

6. Item 4, the average sequence time, is the cumulative average of the sequence times thus far in the file. At the beginning of a file it is initialized at the nominal value.

ASSIGNMENT OF ENCODER FLAGS

	FLAG NO.	DESIGNATION
	1	"1" = University of California Power ON. "0" = University of California Power OFF.
	2	"1" = GRC Power ON. "0" = GRC Power OFF.
	3	"1" = GUM Power ON. "0" = GUM Power OFF.
	4	"1" = TRW Power ON. "0" = TRW Power OFF.
	5	"1" = University of Iowa Power ON. "0" = University of Iowa Power OFF.
	6	"1" = University of Chicago Power ON and with paddles erected. "0" = University of Chicago Power OFF or paddles not erected.
	7	"1" = GSFC (CRT-LED) Power ON. "0" = GSFC (CRT-LED) Power OFF.
	8	"1" = BTL Power ON and separation from 3rd stage. "0" = BTL Power OFF or no separation from 3rd stage.
Channel 3	9	"1" = Magnetometer Power ON. "0" = Magnetometer Power OFF.
Channel 3	10	"1" = Optical Aspect Power ON. "0" = Optical Aspect Power OFF.
Channel 3	11	"1" = APL Power ON. "0" = APL Power OFF.
Channel 3	12	"1" = Flipper Heater ON. "0" = Flipper Heater OFF.
Channel 3	13	"1" = Magnetometer operating in low range (±32 gamma). "0" = Magnetometer operating in high range (±128 gamma).
Channel 3	14	"0" = (Magnetometer up) Z axis sensor fully positioned with numbered end in direction of positive thrust axis. "1" = (Magnetometer up) Z axis sensor not fully positioned with numbered end in direction of positive thrust axis.

FRAME 4	FLAG NO.	DESIGNATION
Channel 3	15	"0" = (Magnetometer down) Z axis sensor fully positioned with numbered end in direction of negative thrust axis.
		"1" = (Magnetometer down) Z axis sensor not fully positioned with numbered end in direction of negative thrust axis.
	16	1" = Magnetometer calibration current ON.
		"0" = Magnetometer calibration current OFF.

4. 5.4 State University of Iowa (SUI) Experimenter Tape Format
Experimenter I. D. : 04 5/9/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1	35-18		Time Quality Flag	I
1	17-0	Days	Day of Frame 0, Channel 0	I
2	All	msecs	Milliseconds of Frame 0, Channel 0	I
3	35-24		Pseudo-sequence County Quality Flag	I
3	23-0	counts	Pseudo-sequence Count	I
4	35-18		Sequence I. D. Quality Flag	I
4	17-0	Counts	Sequence I. D.	I
5	35-18		SUI On/Off Flag	I
5	17-0		Satellite Clock	I
6	35-18		Data Quality Flags for Frame 2, 1a (Channels 2a, 1a, 1b)	I
6	17-0	Counts	Frame 2, 1a	I
7	35-18		Data Quality Flags for Frame 2, 1b (Channels 3b, 3a, 2b)	I
7	17-0	counts	Frame 2, 1b	I
8	35-18		Data Quality Flags for Frame 6, 1a	I
8	17-0	Counts	Frame 6, 1a	I
9	35-18		Data Quality Flags for Frame 6, 1b	I
9	17-0	counts	Frame 6, 1b	I
10	35-18		Data Quality Flags for Frame 10, 1a	I
10	17-0	counts	Frame 10, 1a	I
11	35-18		Data Quality Flags for Frame 10, 1b	I
11	17-0	counts	Frame 10, 1b	I
12	35-18		Data Quality Flags for Frame 14, 1a	I
12	17-0	Counts	Frame 14, 1a	I
13	35-18		Data Quality Flags for Frame 14, 1b	I
13	17-0	counts	Frame 14, 1b	I
14	All	Degrees	Optical Aspect Scan (Spin Axis-Sun Angle).	F
15	All	msecs	OA1 (Sun Time)	F
16	All	msecs	OA2 (Spin Period)	F
17	All	msecs	OA3 (Earth Time)	F

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
18	All	msecs	OA4 (Earth Width)	F
19	All	Volts	PP2 (SUI LEPEDEA)	F
20–323			Data from sixteen more sequences (Items 1–19 repeated 16 times)	
324	All	Volts	PP8 (+28 volt line, average for 17 sequences)	F
325	All	Volts	PP20 (SUI volts, average for 17 sequences)	F
326	All	Degrees	PP17 (BTL temperature near SUI experiment)	F
327	All	Days	Day of Orbit Data	I
328	All	msecs	Milliseconds of Orbit Data	I
329	All	Degrees	Geocentric Longitude Satellite Position	F
330	All	Degrees	Geocentric Latitude Satellite Position	F
331	All	Km	Radial Distance From Center of Earth	F
332	All	Earth Radii	R_o = Geomagnetic Coordinate	F
333	All	Degrees	Geomagnetic Latitude	F
334	All	Earth Radii	L, McIlwain Magnetic Shell Radius	F
335	All	gamma	B, Magnetic Field Strength	F
336	All		B/B_o	F
337	All	Degrees	Right Ascension (Real Field Coordinates)	F
338	All	Degrees	Declination (Real Field Coordinates)	F
339	All	Km	X Solar Ecliptic Satellite Position	F
340	All	Km	Y Solar Ecliptic Satellite Position	F
341	All	Km	Z Solar Ecliptic Satellite Position	F
342	All	Km	X Solar Magnetosphere Satellite Position	F
343	All	Km	Y Solar Magnetosphere Satellite Position	F
344	All	Km	Z Solar Magnetosphere Satellite Position	F
345	All	Km	X Celestial Inertial Satellite Position	F
346	All	Km	Y Celestial Inertial Satellite Position	F
347	All	Km	Z Celestial Inertial Satellite Position	F
348	All	Km	X Celestial Inertial Sun Position	F
349	All	Km	Y Celestial Inertial Sun Position	F

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
350	All	Km	Z Celestial Inertial Sun Position	F
351	All	Degrees	L_{SEP} (Sun-Earth-Probe Angle)	F

This is a seven-track, 556 BPI, binary mode tape. "I" and "F" in the format column indicate integer and floating point, respectively, in Univac 1108 notation. Experiment synchronization will be maintained by the decommutation program on the Univac 1108. Missing data will be indicated by all bits being set to "1".

4.5.5 Southwest Center for Advanced Studies (SCAS) Experimenter Tape Format

Intermediate Tape - Experimenter I. D. : 05 5/9/67

VORD #	BITS	UNITS	IDENTIFICATION		FORMAT
1	All		Telemetry Station I. D.		
2	19–18		Time Quality Flag	Seq. 1	I
2	17-0	Days	Day of Year FR. 0 CH. 0	Seq. 1	I
3	All	msecs	Msecs. of Day FR. 0 CH. 0	Seq. 1	I
4	All	msecs	Msecs. of Day FR. 3 CH. 0	Seq. 1	I
5	All	msecs	Msecs. of Day FR. 11 CH. 0	Seq. 1	I
6	35–30		Seq. Count Qual. Flag	Seq. 1	I
6	21–0	counts	Pseudo-Seq. Count	Seq. 1	I
7	All		Satellite Clock	Seq. 1	I
8	19–18		Seq. I.D. Qual. Flag	Seq. 1	I
8	4–0	counts	Seq. I. D.	Seq. 1	I
9	All	msecs	OA1 (999999 = Bad Data)	Seq. 1	I
10	20–18		Frame 11 - Qual. Flag 4a	Seq. 1	I
10	9–0	counts	Frame 11 - Raw Data 4a	Seq. 1	I
11	20–18		Frame 11 - Qual. Flag 4b	Seq. 1	I
11	9–0	counts	Frame 11 - Raw Data 4b	Seq. 1	I
12	20–18		Frame 11 - Qual. Flag 4c	Seq. 1	I
12	9–0	counts	Frame 11 - Raw Data 4c	Seq. 1	I
13	20–18		Frame 11 - Qual. Flag 4d	Seq. 1	I
13	9–0	counts	Frame 11 - Raw Data 4d	Seq. 1	I
14	20–18		Frame 11 - Qual. Flag 4e	Seq. 1	I
14	9–0	counts	Frame 11 - Raw Data 4e	Seq. 1	I
15	20–18		Frame 11 - Qual. Flag 4f	Seq. 1	I
15	9–0	counts	Frame 11 - Raw Data 4f	Seq. 1	I
16	20–18		Frame 11 - Qual. Flag 4g	Seq. 1	I
16	9–0	counts	Frame 11 - Raw Data 4g	Seq. 1	I
17	20–18		Frame 11 - Qual. Flag 4h	Seq. 1	I
17	9–0	counts	Frame 11 - Raw Data 4h	Seq. 1	I
18	20–18		Frame 11 - Qual. Flag 4i	Seq. 1	I
18	9–0	counts	Frame 11 - Raw Data 4i	Seq. 1	I
19	20–18		Frame 11 - Qual. Flag 4j	Seq. 1	I

WORD #	BITS	UNITS	IDENTIFICATION		FORMAT
19	9-0	counts	Frame 11 - Raw Data 4j	Seq. 1	I
20	19-18		Time Qual. Flag	Seq. 2	I
20	17-0	Days	Day of Yr. FR. 0 CH. 0	Seq. 2	I
21	All	msecs	Msecs. FR. 0 CH. 0	Seq. 2	I
22	All	msecs	Msecs. FR.3 CH. 0	Seq. 2	I
23	All	msecs	Msecs. FR. 11 CH. 0	Seq. 2	
24	35-30		Seq. Count Qual, Flag	Seq. 2	
24	21-0	Counts	Pseudo-Seq. Count	Seq. 2	I
25	All		Satellite Clock	Seq. 2	I
26	19-18		Seq. I.D. Qual. Flag	Seq. 2	I
26	4-0	counts	Seq. I. D.	Seq. 2	I
27	All	Degrees	OA1	Seq. 2	I
28	20-18		Frame 3 - Qual. Flag 4a	Seq. 2	I
28	9-0	counts	Frame 3 - Raw Data 4a	Seq. 2	I
29	20-18		Frame 3 - Qual. Flag 4b	Seq. 2	I
29	9-0	counts	Frame 3 - Raw Data 4b	Seq. 2	I
30	20-18		Frame 3 - Qual. Flag 4c	Seq. 2	I
30	9-0	Counts	Frame 3 - Raw Data 4c	Seq. 2	I
31	20-18		Frame 3 - Qual. Flag 4d	Seq. 2	I
31	9-0	counts	Frame 3 - Raw Data 4d	Seq. 2	I
32	20-18		Frame 3 - Qual. Flag 4e	Seq. 2	I
32	9-0	Counts	Frame 3 - Raw Data 4e	Seq. 2	I
33	20-18		Frame 3 - Qual. Flag 4f	Seq. 2	I
33	9-0	Counts	Frame 3 - Raw Data 4f	Seq. 2	I
34	20-18		Frame 3 - Qual. Flag 4g	Seq. 2	I
34	9-0	counts	Frame 3 - Raw Data 4g	Seq. 2	I
35	20-18		Frame 3 - Qual. Flag 4h	Seq. 2	I
35	9-0	Counts	Frame 3 - Raw Data 4h	Seq. 2	I
36	20-18		Frame 3 - Qual. Flag 4i	Seq. 2	I
36	9-0	Counts	Frame 3 - Raw Data 4i	Seq. 2	I
37	20-18		Frame 3 - Qual. Flag 4j	Seq. 2	I
37	9-0	counts	Frame 3 - Raw Data 4j	Seq. 2	I

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
38	20–18		Frame 11 - Qual. Flag 4a Seq. 2	I
38	9-0	counts	Frame 11 - Raw Data 4a Seq. 2	I
39	20–18		Frame 11 - Qual. Flag 4b Seq. 2	I
39	9–0	counts	Frame 11 - Raw Data 4b Seq. 2	I
40	20–18		Frame 11 - Qual. Flag 4c Seq. 2	I
40	9–0	counts	Frame 11 - Raw Data 4c Seq. 2	I
41	20–18		Frame 11 - Qual. Flag 4d Seq. 2	I
41	9–0	counts	Frame 11 - Raw Data 4d Seq. 2	I
42	20–18		Frame 11 - Qual. Flag 4e Seq. 2	I
42	9–0	Counts	Frame 11 - Raw Data 4e Seq. 2	I
43	20–18		Frame 11 - Qual. Flag 4f Seq.2	I
43	9-0	counts	Frame 11 - Raw Data 4f Seq. 2	I
44	20–18		Frame 11 - Qual. Flag 4g Seq. 2	I
44	9-0	Counts	Frame 11 - Raw Data 4g Seq. 2	I
45	20–18		Frame 11 - Qual. Flag 4h Seq. 2	I
45	9-0	counts	Frame 11 - Raw Data 4h Seq. 2	I
46	20–18		Frame 11 - Qual. Flag 4i Seq. 2	I
46	9–0	counts	Frame 11 - Raw Data 4i Seq. 2	I
47	20–18		Frame 11 - Qual. Flag 4j Seq. 2	I
47	9-0	Counts	Frame 11 - Raw Data 4j Seq. 2	I
48–55			Same as words 20–27 using Seq. 3 data (Seq. I.D. Data)	
56–75			Same as words 28–47 using Seq. 3 data (Raw Data FR. 3 & 11)	
76–83			Same as words 20–27 using Seq. 4 data (Seq. I.D. Data)	
84–103			Same as words 28–47 using Seq. 4 data (Raw Data - FR. 3 & 11)	
104-111			Same as words 20–27 using Seq. 5 data (Seq. I.D. Data)	
112–133			Same as words 28–47 using Seq. 5 data (Raw Data FR. 3 & 11)	
132-139			Same as words 20–27 using Seq. 6 data	

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
140-159			Same as words 28-47 using Seq. 6 data	
160-167			Same as words 20-27 using Seq. 7 data	
168-187			Same as words 28-47 using Seq. 7 data	
188-195			Same as words 20-27 using Seq. 8 data	
196-215			Same as words 28-47 using Seq. 8 data	
216-223			Same as words 20-27 using Seq. 9 data	
224-243			Same as words 28-47 using Seq. 9 data	
244-251			Same as words 20-27 using Seq. '10data	
252-271			Same as words 28-47 using Seq. 10 data	
272-279			Same as words 20-27 using Seq. 11 data	
280-299			Same as words 28-47 using Seq. 11 data	
300-307			Same as words 20-27 using Seq. 12 data	
308-327			Same as words 28-47 using Seq. 12 data	
328-335			Same as words 20-27 using Seq. 13 data	
336-355			Same as words 28-47 using Seq. 13 data	
356-383			Same as words 20-47 using Seq. 14 data	
384-411			Same as words 20-47 using Seq. 15 data	
412-439			Same as words 20-47 using Seq. 16 data	
440-467			Same as words 20-47 using Seq. 17 data	
468-495			Same as words 20-47 using Seq. 18 data	
496-523			Same as words 20-47 using Seq. 19 data	
524-551			Same as words 20-47 using Seq. 20 data	
552-579			Same as words 20-47 using Seq. 21 data	
580-607			Same as words 20-47 using Seq. 22 data	
608-635			Same as words 20-47 using Seq. 23 data	
636-663			Same as words 20-47 using Seq. 24 data	
664-691			Same as words 20-47 for Seq. 25 data	
692-719			Same as words 20-47 for Seq. 26 data	
720-747			Same as words 20-47 for Seq. 27 data	
748-775			Same as words 20-47 for Seq. 28 data	
776-803			Same as words 20-47 for Seq. 29 data	
804-831			Same as words 20-47 for Seq. 30 data	

VORD #	BITS	UNITS	IDENTIFICATION		FORMAT
832-859			Same as words 20–47 for Seq. 31 data		
360-887			Same as words 20–47 for Seq. 32 data		
888	19-18		Time Quality Flag	Seq. 33	
888	17-0	Days	Day of Yr. Fr. 0 Ch. 0	Seq. 33	
889	All	msecs	Msecs. Fr. 0 Ch. 0	Seq. 33	
890	All	msecs	Msecs. Fr. 3 Ch. 0	Seq. 33	
891	All	msecs	Msecs. Fr. 11 Ch. 0	Seq. 33	
892	35-30		Seq. Count Qual. Flag	Seq. 33	I
892	21-0	counts	Pseudo-Seq. Count	Seq. 33	I
893	All		Satellite Clock	Seq. 33	I
894	19-18		Seq. I.D. Qual. Flag	Seq. 33	I
a94	4-0	counts	Seq. I. D.	Seq. 33	I
a95	All	Degrees	OA1	Seq. 33	I
896	20-18		Frame 3 - Qual. Flag 4a	Seq. 33	I
896	9-0	counts	Frame 3 - Raw Data 4a	Seq. 33	I
897	20-18		Frame 3 - Qual. Flag 4b	Seq. 33	I
897	9-0	counts	Frame 3 - Raw Data 4b	Seq. 33	I
898	20-18		Frame 3 - Qual. Flag 4c	Seq. 33	I
898	9-0	counts	Frame 3 - Raw Data 4c	Seq. 33	I
899	20-18		Frame 3 - Qual. Flag 4d	Seq. 33	I
899	9-0	counts	Frame 3 - Raw Data 4d	Seq. 33	I
900	20-18		Frame 3 - Qual. Flag 4e	Seq. 33	I
900	9-0	counts	Frame 3 - Raw Data 4e	Seq. 33	I
901	20-18		Frame 3 - Qual. Flag 4f	Seq. 33	I
901	9-0	counts	Frame 3 - Raw Data 4f	Seq. 33	I
902	20-18		Frame 3 - Qual. Flag 4g	Seq. 33	I
902	9-0	counts	Frame 3 - Raw Data 4g	Seq. 33	I
903	20-18		Frame 3 - Qual. Flag 4h	Seq. 33	I
903	9-0	counts	Frame 3 - Raw Data 4h	Seq. 33	I
904	20-18		Frame 3 - Qual. Flag 4i	Seq. 33	I
904	9-0	counts	Frame 3 - Raw Data 4i	Seq. 33	I

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
905	20–18		Frame 3 - Qual. Flag 4j Seq. 33	I
905	9–0	counts	Frame 3 - Raw Data 4j Seq. 33	I
906		msecs	OA2 999999 For Bad (Average for 32 sequences)	I
907		Volts	PP4 All 999.99 for Bad (Average for 32 sequences)	F
908		Amps	PP5 All 999.99 for Bad (Average for 32 sequences)	F
909		Amps	PP6 All 999.99 For Bad (Average for 32 sequences)	F
910		Volts	PP7 (Average for 32 sequences)	F
911		Volts	PP14 (Average for 32 sequences)	F
912		Degrees	PP18 (Average for 32 sequences)	F
913		Degrees	PP23 (Average for 32 sequences)	F
914		Degrees	PP25 (Average for 32 sequences)	F
915		Degrees	PP26 (Average for 32 sequences)	F
916		Degrees	PP28 (Average for 32 sequences)	F
917		Days	Day of Year	I
918		msecs	Msecs. of Day	I
919		Degrees	Latitude } Satellite Position in	F
920		Degrees	Longitude } Geomagnetic Coordinates	F
921		Kms	X } Satellite Position in Geocentric	F
922		Kms	} Solar Ecliptic Coordinates	F
923		Kms	Z }	F
924		Kms	Radial Dist. of Satellite from center of earth	F
925		Kms	X } Satellite Position in Geocentric	F
926		Kms	Y } Solar Magnetospheric Coordinates	F
927		Kms	Z }	F
928		Kms	X } Moon Position in Geocentric	F
929		Kms	} Solar Ecliptic Coordinates	F
930		Kms	Z }	F

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
931		Kms	X	F
932		Kms		F
933		Kms		F
934		Kms		F
935		Kms		F
936		Degrees		F
937		Degrees		F
938		Kms		F
939		Kms		F
940		Kms		F
941				I
942			1st Row, 1st Column — Geocentric Solar Ecliptic to Geocentric Solar Magnetospheric Transformation Matrix	F
943			1st Row, 2nd Column	F
944			1st Row, 3rd Column	F
945			2nd Row, 1st Column	F
946			2nd Row, 2nd Column	F
947			2nd Row, 3rd Column	F
948			3rd Row, 1st Column	F
949			3rd Row, 2nd Column	F
950			3rd Row, 3rd Column	F
951			Geocentric Equatorial Inertial to Geocentric Solar Ecliptic Transformation Matrix	F
952				F
953			1st Row, 3rd Column	F
954			2nd Row, 1st Column	F
955			2nd Row; 2nd Column	F
956			2nd Row, 3rd Column	F

JORD #	BITS	UNITS	IDENTIFICATION		FORMAT
957			3rd Row, 1st Column	Geocentric Equatorial Inertial to Geocentric Solar Ecliptic Transformation Matrix	F
958			3rd Row, 2nd Column		F
959			3rd Row, 3rd Column		F
960		Degrees	Latitude	Satellite Position in Geocentric Coordinates	F
961		Degrees	Longitude		F

This tape is used as input to the SCAS Post-Processor program. The tape is 7-track, binary, 556 BPI density.

"I" and "F" in the FORMAT column indicate integer and floating point respectively in UNIVAC 1108 notation. Negative numbers are denoted by the 1's complement of the positive value.

4.5.5 Southwest Center for Advanced Studies Experimenter Tape Format (Continued)

Post Processor - Experimenter I. D. : 05 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Telemetry Station I. D.	I6
2			Time Quality Flags	I1
3		Time	Day of Year Frame 0 Channel 0 1st Sequence	I3
4		Time	Milliseconds of Day Frame 0 Channel 0	I8
5			Pseudo-Sequence Count Quality Flags	I2
6		counts	Pseudo-Sequence Count	I7
7		Counts	Satellite Clock	I5
8		counts	Sync Status	I3
9		counts	SOCT (L, M)	F9.1
10		Counts	AV (L, M) } L=1, M=1	F9.1
11		counts	ER (L, M) } L=1, M=1	F9.1
12		Counts	NT (L, M) } L=1, M=1	I2
13		counts	Same as above words 9, 10, 11, 12; L=1, M=2	
14		Counts		
15		counts		
16		counts		
17 ↓ 40		counts ↓ counts	Same as above words 9, 10, 11, 12; L=1, M=3, . . ., 8	
41 ↓ 200		Counts ↓ counts	Same as above words 9-40 with L=2, . . ., 6 for every value of L, M=1, . . ., 8	
201		counts	AV (7, M) } M=1	F9.1
202		counts	ER (7, M) } M=1	F9.1
203		Counts	NT (7, M) } M=1	I2
204 ↓ 221		counts ↓ counts	Same as above words 201-203 for M=2, . . ., 7	
222		counts	AVE (8, M) } M=1	F9.1
223		counts	ERE (8, M) } M=1	F9.1
224		counts	NTE (8, M) } M=1	I2
225 ↓ 242		counts ↓ counts	Same as above words 225-242 for M-2, . . ., 7	

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
243		counts	AVO (8, M) M=1	F9.1
244		Counts	ERO (8, M)	F9.1
245		counts	NTO (8, M)	I2
246 ↓ 263		counts ↓ counts	Same as above words 243–245 for M–2, . . ., 7	
264		Counts	RATE (64,	F9.1
265		counts	SIG (64, M)	F9.1
266 ↓ 277		Counts ↓ counts	Same as above words 264-265 for M–2,. . ., 7	
278		counts	AV (L, 9) L=1	F9.1
279		Counts	ER (L, 9)	F9.1
280		counts	NT (L, 9)	I2
281 ↓ 289		Counts ↓ counts	Same as above words 278–280 for L=2, . . ., 4	
290		Counts	AV (7, 8)	F9.1
291		Counts	ER (7, 8)	F9.1
292		counts	NT (7, 8)	I2
293		counts	AVE (8, 8)	F9.1
294		counts	ERE (8, 8)	F9.1
295		Counts	NTE (8, 8)	I2
296		counts	AVO (8, 8)	F9.1
297		counts	ERO (8, 8)	F9.1
298		counts	NTO (8, 8)	I2
299		counts	RATE (L, 9)	F9.1
300		counts	SIG (L, 9) L=l	F9.1
301 ↓ 426		counts ↓ counts	Same as above words 299–300 for L=2, . . ., 64	
427			Time Quality Flags	I1
428		Days	Day of Year Frame 9 Channel 0 list Sequence	I3
429		msecs	Milliseconds of Day Frame 9 Channel 0 Data (8K+L-8, M) where	I8

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
			M=1. . .24 varies first L=1. . . 8 varies second K=1. . . 8 varies third	
430		counts	M=1 L=1 K-1	I4
431		counts	M=2	I4
432		counts	M=3	I4
433		counts	M=4	I4
434		counts	M=5	I4
435		counts	M=6	I4
436		counts	M=7	I4
437		counts	M=8	I4
438		counts	M=9	I4
439		Counts	M=10	I4
440		counts	M=11	I4
441		Counts	M=12	I3
442		counts	M=13	I3
443		counts	M=14	I2
444		counts	M=15	I2
445		counts	M=16	I2
446		counts	M=17	I2
447		Counts	M=18	I2
448		counts	M=19	I2
449		Counts	M=20	I2
450		counts	M=21	I2
451		msecs	M=22	I4
452		counts	M=23	I5
453		counts	M=24* See Data Cond. Indic. page IV-87	I10
454 ↓ 1965			Same as words 430, 453 for L=1, . . ., 8 and K=1, . . ., 8	
1966		Volts	PP4 (average for 32 sequences)	F6.2
1967		Amps	5 (average for 32 sequences)	F6.2

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1968		Amps	6 (average for 32 sequences)	F6.2
1969		Volts	7 (average for 32 sequences)	F6.2
1970		Degrees	14 (average for 32 sequences)	F6.2
1971		Degrees	18 (average for 32 sequences)	F6.2
1972		Degrees	23 (average for 32 sequences)	F6.2
1973		Degrees	25 (average for 32 sequences)	F6.2
1974		Degrees	26 (average for 32 sequences)	F6.2
1975		Degrees	28 (average for 32 sequences)	F6.2
1976		msecs	OA-2 Spin Period	I4
1977		Days	Day of Orbit Data	I3
1978		msecs	Milliseconds of Day of Orbit Data	I8
1979		Degrees	Geomagnetic Latitude Satellite Position	F7.3
1980		Degrees	Geomagnetic Longitude Satellite Position.	F8.3
1981		Kms	X Solar Ecliptic Satellite Position	F10.2
1982		Kms	Y Solar Ecliptic Satellite Position	F10.2
1983		Kms	Z Solar Ecliptic Satellite Position	F10.2
1984		Kms	Radial Distance to Satellite from Earth's Center	F10.3
1985		Kms	X Solar Magnetosphere Satellite Position	F10.2
1986		Kms	Y Solar Magnetosphere Satellite Position	F10.2
1987		Kms	Z Solar Magnetosphere Satellite Position	F10.2
1988		Kms	X Solar Ecliptic Moon Position	F10.2
1989		Kms	Y Solar Ecliptic Moon Position	F10.2
1990		Kms	Z Solar Ecliptic Moon Position	F10.2
1991		Kms	X Solar Magnetosphere Moon Position	F10.2
1992		Kms	Y Solar Magnetosphere Moon Position	F10.2
1993		Kms	Z Solar Magnetosphere Moon Position	F10.2
1994		Kms	Distance from satellite to moon	F10.2
1995		Kms	Distance from satellite to the moon which is parallel to the X axis	F10.2
1996		Degrees	Geomagnetic Latitude Sun Position	F10.2
1997		Degrees	Geomagnetic Longitude Sun Position	F10.2

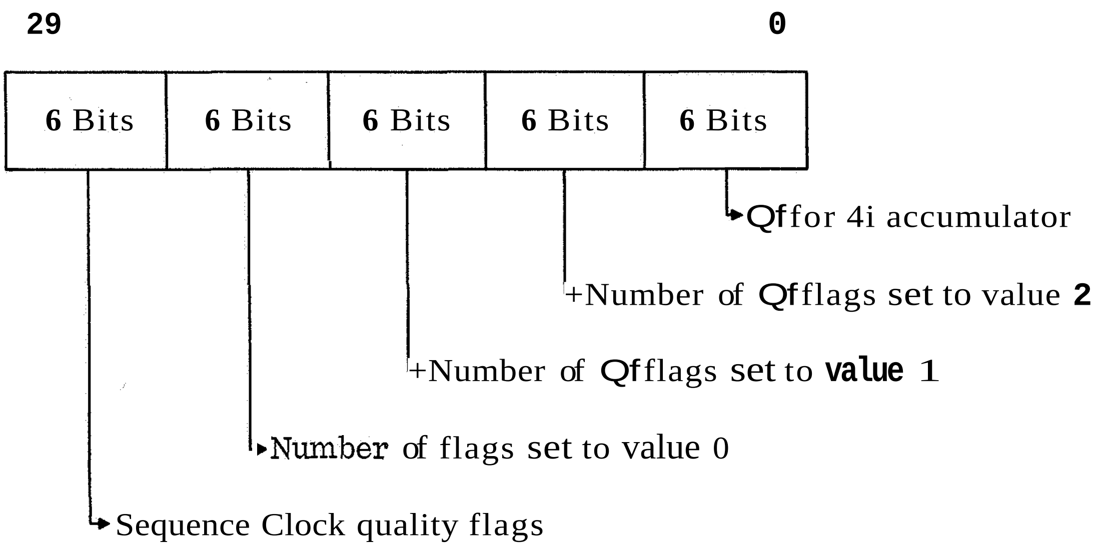
ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1998			X Theoretical Geomagnetic Field in Solar Ecliptic	F10.2
1999			Y Theoretical Geomagnetic Field in Solar Ecliptic	F10.2
2000			Z Theoretical Geomagnetic Field in Solar Ecliptic	F10.2
2001		Gamma	Magnitude of the Theoretical Geomagnetic Field in Solar Ecliptic	F10.2
2002 ↓ 2010			Rotation Matrix from Solar Ecliptic to Solar Magnetic	F8.4 F8.4
2011 ↓ 2019			Rotation Matrix from Celestial Inertial to Solar Ecliptic	F8.4
2020		Degrees	Geocentric Latitude Satellite Position	F7.3
2021		Degrees	Geocentric Longitude Satellite Position	F8.3

This is a 7-track, BCD, 556 PI tape.

The following FORMAT statement was used to write this data:

FORMAT (I6, I1, I3, I8, I2, I7, I5, I3, /4(3F9.1, I2)/, 11(4(3F9.1, I2)/), I3(6(2F9.1, I2,)/, 2F9.1, I2, /), 14F9.1, /, 6(2F9.1, I2), /, 2F9.1, I2, /28(14(F9.1), /, 2F9.1, /), I1, I3, I8, /, 64(11I4, 2I3, 8I2, I4, I5, I10, /), 310F6.2.14,
3I3, I8, F7.3, F8.3, 3F10.2, F10.3, /, 13F10.2, /, 4F10.2, 11F8.4, /, 7F8.4, 4F7.3, F8.3)

DATA CONDITION INDICATOR



This word will be read out with an I10 Format. When read back into the computer with this Format, the 5 flags will be in the low-order 30 bits of the computer word.

4.5.6 TRW Experimenter Tape Format

Raw Data Tape - Experimenter I. D. : 06 5/9/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1	35-31		Pseudo-Sequence Count Quality Flags	I
1	30-9	counts	Pseudo-Sequence Count, 1st Seq. of TRW Cycle	I
1	8-0	Days	Day of Year of Frame 0, Channel 0, 1st Seq.	I
2	8-0		Same as Word 1 for Seq. 2 – 16 of TRW Cycle	
↓	8-0			
16	8-0			
17 ↓ 32			Satellite Clock for Seq. 1 → 16 of TRW Cycle	
33	17-18		Seq. I.D. Quality Flags	I
33	4-0	Counts	Seq. I. D., 1st Seq. of TRW Cycle	I
34 ↓ 48			Same as Word 33 for Seq. 2 – 16 of TRW Cycle	
49		msecs	Milliseconds of Frame 0, Channel 0, Seq. 1	I
↓ 64			Same as Word 49 for Seq. 2 → 16 of TRW Cycle	
65	31-30		Time Quality Seq. 1	I
65	29-28		Time Quality Seq. 2	I
65	27-26		Time Quality Seq. 3	I
65	25-24		Time Quality Seq. 4	I
65	23-22		Time Quality Seq. 5	I
65	21-20		Time Quality Seq. 6	I
65	19-18		Time Quality Seq. 7	I
65	17-16		Time Quality Seq. 8	I
65	15-14		Time Quality Seq. 9	I
65	13-12		Time Quality Seq. 10	I
65	11-10		Time Quality Seq. 11	I
65	9-8		Time Quality Seq. 12	I
65	7-6		Time Quality Seq. 13	I
65	5-4		Time Quality Seq. 14	I

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
65	3-2		Time Quality Seq. 15	I
65	1-0		Time Quality Seq. 16	I
66		Degrees	PP 17 (Average of 8 Values)	F
67		Degrees	PP 18 (Average of 8 Values)	F
68		Degrees	PP 25 (Average of 8 Values)	F
69		Degrees	PP 26 (Average of 8 Values)	F
70		Degrees	PP 28 (Average of 8 Values)	F
71		Volts	PP 7 Seq. 1	F
72 ↓ 86			Same as Word 71 for Seq. 2—16 of TRW Cycle	F
87		Volts	PP 1 Sequence 1	F
88 ↓ 102			Same as Word 87 for Seq. 2→16 of TRW Cycle	F
103	15		TRW On/Off Flag Seq. 1	I
103	14		TRW On/Off Flag Seq. 2	I
103	13		TRW On/Off Flag Seq. 3	I
103	12		TRW On/Off Flag Seq. 4	I
103	11		TRW On/Off Flag Seq. 5	I
103	10		TRW On/Off Flag Seq. 6	I
103	9		TRW On/Off Flag Seq. 7	I
103	8		TRW On/Off Flag Seq. 8	I
103	7		TRW On/Off Flag Seq. 9	I
103	6		TRW On/Off Flag Seq. 10	I
103	5		TRW On/Off Flag Seq. 11	I
103	4		TRW On/Off Flag Seq. 12	I
103	3		TRW On/Off Flag Seq. 13	I
103	2		TRW On/Off Flag Seq. 14	I
103	1		TRW On/Off Flag Seq. 15	I
103	0		TRW On/Off Flag Seq. 16	I
104		Amps	Spacecraft Eclipse Indicator (PP3)	F
105			Blank	

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
106		counts	Data Word Frame 1 Channel 4	I
107		Counts	Data Word Frame 1 Channel 5	I
108		counts	Data Word Frame 1 Channel 6	I
109		counts	Data Word Frame 1 Channel 7	I
110		counts	Data Word Frame 5 Channel 4	I
111		Counts	Data Word Frame 5 Channel 5	I
112		counts	Data Word Frame 5 Channel 6	I
113		counts	Data Word Frame 5 Channel 7	I
114		counts	Data Word Frame 9 Channel 4 Seq. 1	I
115		Counts	Data Word Frame 9 Channel 5	I
·116		Counts	Data Word Frame 9 Channel 6	I
117		counts	Data Word Frame 9 Channel 7	I
118		counts	Data Word Frame 13 Channel 4	I
119		counts	Data Word Frame 13 Channel 5	I
120		counts	Data Word Frame 13 Channel 6	I
121		Counts	Data Word Frame 13 Channel 7	I
122 ↓ 361			Same as Words 106-121 for Seq. 2 → 16 of TRW Cycle	I I
362			Data Quality, 1st Data Word. (Word is 8-Bit Telemetry Sample)	
363 ↓ 617			Same as Word 362 for 256 Flags	
618		msecs	Average TRW Cycle Time	F
619		Degrees	OA Scan	F
620		msecs	OA 1	F
621		msecs	OA 2	F
622		msecs	OA 3	F
623			OA 4	F
624 ↓ 698			Same as Words 619-623 for Seq. 2—16 of TRW Cycle	
699		Days	Day of Orbit Data	I
700		msecs	Milliseconds of Day	I

a

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
701		Degrees	Longitude } Satellite Position in	F
702		Degrees	Latitude } Geocentric Coordinates	F
703		Degrees	Longitude } Satellite Position in	F
704		Degrees	Latitude } Geomagnetic Coordinates	F
705		Km	Radial Distance from the Center of Earth to Satellite	F
706		Km	X } Satellite Position in Solar Ecliptic Coordinates (E. R.)	F
707		Km		F
708		Km	Z	F
709			X } Solar Ecliptic Coordinates of Theoretical Geomagnetic Field	F
710				F
711			Z	F
712		Kms/Sec	Magnitude of Velocity	F
713		Degrees	Right Ascension } Inertial Ecliptic	F
714		Degrees	Declination } Satellite Position	F
715		Earth Radii	A = McIlwain Parameter } Real Field Coordinate	F
716		Gamma	B = Field Strength } System	F
717		Degrees	Satellite-Earth-Sun Angle (L_{SEP})	F

"I" and "F" in the FORMAT column indicate integer and floating point respectively in UNIVAC 1108 notation. Negative numbers are denoted by the 1's complement of the positive value.

a

4.5.6 TRW Experimenter Tape Format (continued)

Post Processor (Format 1)- Experimenter I.D. : 06 1/6/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Control Word (000634000001)	I
2			Record Flag 0 = Good Data, Format 2 Record Flag 1 = Bad Spin, Format 1 Record Flag 2 = Wrong # of Deletions, Format 1	I
3	0–4		Pseudo-Sequence Count Quality Flags	I
	5–26	counts	Pseudo-Sequence Count, Seq. 1 of TRW Cycle	
	27–35	Days	Day of Year Frame 0, Channel 0, Seq. 1	
4 ↓ 18			Same as Word 3 for Seq. 2–16 of TRW Cycle	
19	16–17		Sequence I. D. Quality Flags	I
	31–35	Counts	Sequence I. D., Seq. 1 of TRW Cycle	
20 ↓ 34			Same as Word 19 for Seq. 2–16 of TRW Cycle	
35	0–1		Satellite Clock Quality, Seq. 1	I
35	2–17		Satellite Clock, Seq. 1	
36 ↓ 50			Same as Word 35 for Seq. 2–16 of TRW Cycle	
51		msecs	Milliseconds of Frame 0, Channel 0, Seq. 1	I
52 ↓ 66			Same as Word 51 for Seq. 2–16 of TRW Cycle	
67	4–5		Time Quality, Sequence 1	I
	6–7		Time Quality, Sequence 2	
	8–9		Time Quality, Sequence 3	
	10–11		Time Quality, Sequence 4	
	12–13		Time Quality, Sequence 5	
	14–15		Time Quality, Sequence 6	
	16–17		Time Quality, Sequence 7	
	18–19		Time Quality, Sequence 8	
	20–21		Time Quality, Sequence 9	

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
	22-23		Time Quality, Sequence 10	
	24-25		Time Quality, Sequence 11	
	26-27		Time Quality, Sequence 12	
	28-29		Time Quality, Sequence 13	
	30-31		Time Quality, Sequence 14	
	32-33		Time Quality, Sequence 15	
	34-35		Time Quality, Sequence 16	
68		Degrees	PP 17 (Average of 8 Values)	F
69		Degrees	PP 18 (Average of 8 Values)	F
70		Degrees	PP 25 (Average of 8 Values)	F
71		Degrees	PP 26 (Average of 8 Values)	F
72		Degrees	PP 28 (Average of 8 Values)	F
73		Volts	PP 7 Sequence 1	F
74 ↓ 88			Same as Word 73 for Seq. 2-16 of TRW Cycle	F
89		Volts	PP 1 Sequence 1	
90 ↓ 104			Same as Word 89 for Seq. 2-16 of TRW Cycle	F
105	20		TRW On/Off Flag, Sequence 1	I
	21		TRW On/Off Flag, Sequence 2	
	22		TRW On/Off Flag, Sequence 3	
	23		TRW On/Off Flag, Sequence 4	
	24		TRW On/Off Flag, Sequence 5	
	25		TRW On/Off Flag, Sequence 6	
	26		TRW On/Off Flag, Sequence 7	
	27		TRW On/Off Flag, Sequence 8	
	28		TRW On/Off Flag, Sequence 9	
	29		TRW On/Off Flag, Sequence 10	
	30		TRW On/Off Flag, Sequence 11	
	31		TRW On/Off Flag, Sequence 12	
	32		TRW On/Off Flag, Sequence 13	

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
	33		TRW On/Off Flag, Sequence 14	
	34		TRW On/Off Flag, Sequence 15	
	35		TRW On/Off Flag, Sequence 16	
106		Amps	Spacecraft Eclipse Indicator (PP3)	F
107		msecs	Sun Aspect Dead Time	F
108	0–8	counts	Data Word Frame 1, Channel 4	I
	9–17	counts	Data Word Frame 1, Channel 5	
	18–26	Counts	Data Word Frame 1, Channel 6	
	27–35	counts	Data Word Frame 1, Channel 7	
109	0–8	Counts	Data Word Frame 5, Channel 4	
	9–17	Counts	Data Word Frame 5, Channel 5	
	1%–26	counts	Data Word Frame 5, Channel 6	
	27–35	counts	Data Word Frame 5, Channel 7 Seq. 1	
110	0–8	Counts	Data Word Frame 9, Channel 4	
	9–17	counts	Data Word Frame 9, Channel 5	
	18–26	Counts	Data Word Frame 9, Channel 6	
	27–35	Counts	Data Word Frame 9, Channel 7	
111	0–8	Counts	Data Word Frame 13, Channel 4	
	9–17	counts	Data Word Frame 13, Channel 5	
	18–26	Counts	Data Word Frame 13, Channel 6	
	27–35	counts	Data Word Frame 13, Channel 7	
112 ↓ 171			Same as Words 10%–11for Seq. 2–16 of TRW Cycle	I
172	0–1		Data Quality, 1st Data Word (Word is 8 Bit Telemetry Source)	I
	2–3		Data Quality, 2nd Data Word	
	4–5		Data Quality, 3rd Data Word	
	6–7		Data Quality, 4th Data Word	
	8–9		Data Quality, 5th Data Word	
	10–11		Data Quality, 6th Data Word	
	12–13		Data Quality, 7th Data Word	
	14–15		Data Quality, 8th Data Word	

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
	16–17		Data Quality, 9th Data Word	
	18–19		Data Quality, 10th Data Word	
	20–21		Data Quality, 11th Data Word	
	22–23		Data Quality, 12th Data Word	
	24–25		Data Quality, 13th Data Word	
	26–27		Data Quality, 14th Data Word	
	28–29		Data Quality, 15th Data Word	
	30–31		Data Quality, 16th Data Word	
	32–33		Data Quality, 17th Data Word	
	34–35		Data Quality, 18th Data Word	
173			Data Quality for 19th–36th Data Word	I
174			Data Quality for 37th–54th Data Word	
175			Data Quality for 55th–72nd Data Word	
176			Data Quality for 73rd–90th Data Word	
177			Data Quality for 91st–108 Data Word	
178			Data Quality for 109th–126 Data Word	
179			Data Quality for 127th–144 Data Word	
180			Data Quality for 145th–162 Data Word	
181			Data Quality for 163rd–180 Data Word	
182			Data Quality for 181–198 Data Word	
183			Data Quality for 199–217 Data Word	
184			Data Quality for 217–234 Data Word	
185			Data Quality for 235–252 Data Word	I
186			Data Quality for 253–256 Data Word	I
187		Degrees	OA Scan	F
188		msecs	OA 1	F
189		msecs	OA 2	F
190		msecs	OA 3	F
191		msecs	OA 4	F
192 ↓ 266			Same as Words 187–191 for Seq. 2–16 of TRW Cycle	F

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
267			TRW Data Cycle Quality Indicator	I
268		msecs	AVG TRW Cycle Time	F
269-393			Zero Filled	I
394		Days	Day of Orbit Data	I
395		msecs	Milliseconds of Day	I
396		Degrees	Longitude } Satellite Position in Geocentric Coordinates	F
397		Degrees	Latitude } Satellite Position in Geocentric Coordinates	F
398		Degrees	Longitude } Satellite Position in Geomagnetic Coordinates	F
399		Degrees	Latitude } Satellite Position in Geomagnetic Coordinates	F
400		Kms	Radial Distance from the Center of Earth to Satellite	F
401		Kms	X } Satellite Position in Solar Ecliptic Coordinates (E. R.)	F
402		Kms	Y } Satellite Position in Solar Ecliptic Coordinates (E. R.)	F
403		Kms	Z } Satellite Position in Solar Ecliptic Coordinates (E. R.)	
404			X } Solar Ecliptic Coordinates of Theoretical Geomagnetic Field	F
405			Y } Solar Ecliptic Coordinates of Theoretical Geomagnetic Field	F
406			Z } Solar Ecliptic Coordinates of Theoretical Geomagnetic Field	F
407		Kms/Sec	Magnitude of Velocity	F
408		Degrees	Right Ascension } Inertial Ecliptic Satellite Position	F
409		Degrees	Declination } Inertial Ecliptic Satellite Position	F
410		Earth Radii	L = Mc Ilwain Parameter } Real Field Coordinate System	F
411		Gamma	B = Field Strength } Real Field Coordinate System	F
412		Degrees	Satellite-Earth-Sun Angle (L_{SEP})	F
413		Kms	X } Satellite Position in Geocentric Solar Magnetospheric Coordinates	F
414		Kms	} Satellite Position in Geocentric Solar Magnetospheric Coordinates	F
415		Kms	Z } Satellite Position in Geocentric Solar Magnetospheric Coordinates	F
416		Degrees	Longitude } Sub-Solar Point in Geomagnetic Coordinates	F
417		Degrees	Latitude } Sub-Solar Point in Geomagnetic Coordinates	F

COMMENTS: This data will be written in binary on a 7-track, 800 BPI density tape, such that it may be read on an IBM 7090 by a FORTRAN Read (I) List statement. In the "Format" Column, "I" represents 36-bit integer and "F" represents an IBM 7090 36-bit floating point number.

4.5.6 TRW Experimenter Tape Format (continued)

Post Processor (Format 2) - Experimenter I. D. : 06 6/1/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Control Word (00634000001)	I
2			Record Flag 0 = Good Data Record, Format #2	I
			Record Flag 1 = Bad Spin, Format #1	I
			Record Flag 2 = Wrong Number of Deletions, Format #1	I
3	0–4		Pseudo-Sequence Count Quality Flags	I
3	5–26	Counts	Pseudo-Sequence Count, Seq. 1 of TRW Cycle	I
3	27–35	Days	Day of Frame 0, Channel 0, Seq. 1	I
4	13–17		Satellite Clock Quality Flags	I
4	18–35		Satellite Clock, 1st Seq. of TRW Data Cycle	I
5		msecs	Milliseconds of Frame 0, Channel 0, Seq. 1	I
6		msecs	Milliseconds of Frame 0, Channel 0, Seq. 2	I
7		msecs	Milliseconds of Frame 0, Channel 0, Seq. 3	I
8		msecs	Milliseconds of Frame 0, Channel 0, Seq. 4	I
9		msecs	Milliseconds of Frame 0, Channel 0, Seq. 5	I
10		msecs	Milliseconds of Frame 0, Channel 0, Seq. 6	I
11		msecs	Milliseconds of Frame 0, Channel 0, Seq. 7	I
12		msecs	Milliseconds of Frame 0, Channel 0, Seq. 8	I
13		msecs	Milliseconds of Frame 0, Channel 0, Seq. 9	I
14		msecs	Milliseconds of Frame 0, Channel 0, Seq. 10	I
15		msecs	Milliseconds of Frame 0, Channel 0, Seq. 11	I
16		msecs	Milliseconds of Frame 0, Channel 0, Seq. 12	I

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
17		msecs	Milliseconds of Frame 0, Channel 0, Seq. 13	I
18		msecs	Milliseconds of Frame 0, Channel 0, Seq. 14	I
19		msecs	Milliseconds of Frame 0, Channel 0, Seq. 15	I
20		msecs	Milliseconds of Frame 0, Channel 0, Seq. 16	I
21	4–5		Time Quality, Sequence 1	I
	6–7		Time Quality, Sequence 2	I
	8–9		Time Quality, Sequence 3	I
	10–11		Time Quality, Sequence 4	I
	12–13		Time Quality, Sequence 5	I
	14–15		Time Quality, Sequence 6	I
	16–17		Time Quality, Sequence 7	I
	18–19		Time Quality, Sequence 8	I
	20–21		Time Quality, Sequence 9	I
	22–23		Time Quality, Sequence 10	I
	24–25		Time Quality, Sequence 11	I
	26–27		Time Quality, Sequence 12	I
	28–29		Time Quality, Sequence 13	I
	30–31		Time Quality, Sequence 14	I
	32–33		Time Quality, Sequence 15	I
	34–35		Time Quality, Sequence 16	I
22		msecs	Average TRW Cycle Time	F
23		Degrees	PP 17 (Average of 8 Values)	F
24		Degrees	PP 18 (Average of 8 Values)	F
25		Degrees	PP 25 (Average of 8 Values)	F
26		Degrees	PP 26 (Average of 8 Values)	F
27		Degrees	PP 28 (Average of 8 Values)	F
28		Volts	PP 7 Sequence 1	F
29		Volts	PP 7 Sequence 2	F
30		Volts	PP 7 Sequence 3	F

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
31		Volts	PP 7 Sequence 4	F
32		Volts	PP 7 Sequence 5	F
33		Volts	PP 7 Sequence 6	F
34		Volts	PP 7 Sequence 7	F
35		Volts	PP 7 Sequence 8	F
36		Volts	PP 7 Sequence 9	F
37		Volts	PP 7 Sequence 10	F
38		Volts	PP 7 Sequence 11	F
39		Volts	PP 7 Sequence 12	F
40		Volts	PP 7 Sequence 13	F
41		Volts	PP 7 Sequence 14	F
42		Volts	PP 7 Sequence 15	F
43		Volts	PP 7 Sequence 16	F
44		Volts	PP 1 Sequence 1	F
45		Volts	PP 1 Sequence 2	F
46		Volts	PP 1 Sequence 3	F
47		Volts	PP 1 Sequence 4	F
48		Volts	PP 1 Sequence 5	F
49		Volts	PP 1 Sequence 6	F
50		Volts	PP 1 Sequence 7	F
51		Volts	PP 1 Sequence 8	F
52		Volts	PP 1 Sequence 9	F
53		Volts	PP 1 Sequence 10	F
54		Volts	PP 1 Sequence 11	F
55		Volts	PP 1 Sequence 12	F
56		Volts	PP 1 Sequence 13	F
57		Volts	PP 1 Sequence 14	F
58		Volts	PP 1 Sequence 15	F
59		Volts	PP 1 Sequence 16	F
60	20		TRW On/Off Flag, Sequence 1	I
	21		TRW On/Off Flag, Sequence 2	I
	22		TRW On/Off Flag, Sequence 3	I

YORD #	BITS	UNITS	IDENTIFICATION	FORMAT
	23		TRW On/Off Flag, Sequence 4	I
	24		TRW On/Off Flag, Sequence 5	I
	25		TRW On/Off Flag, Sequence 6	I
	26		TRW On/Off Flag, Sequence 7	I
	27		TRW On/Off Flag, Sequence 8	I
	28		TRW On/Off Flag, Sequence 9	I
	29		TRW On/Off Flag, Sequence 10	I
	30		TRW On/Off Flag, Sequence 11	I
	31		TRW On/Off Flag, Sequence 12	I
	32		TRW On/Off Flag, Sequence 13	I
	33		TRW On/Off Flag, Sequence 14	I
	34		TRW On/Off Flag, Sequence 15	I
	35		TRW On/Off Flag, Sequence 16	I
61		Amps	Spacecraft Eclipse Indicator (PP3)	F
62		msecs	Sun-Aspect Dead Time	F
63			TRW Data Cycle Quality Indicator	I
64 64	0-8 9-17		} 1st Pair Peak Positive Ion Flux Rate	I
64 64	18-26 27-35		} 2nd Pair Peak Positive Ion Flux Rate	
65 ↓ 79			} Same as Word 64 for 3rd thru 32nd Pairs of Peak Positive Ion Flux Rate	I
80 80	0-8 9-17		} 1st Background Flux Rate	I
80 80	18-26 27-35		} Current & Frequency Calibration	
81	0-8 9-17		} Multiplier Calibration	I
	18-26 27-35		} 2nd Background Flux Rate	
82 82	0-8 9-17		} 1st Pair Peak Electron Flux Rate	I
82 82	18-26 27-35		} 2nd Pair Peak Electron Flux Rate	I

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
83 – 88			Same as Word 82 for 3rd thsu 14 Pairs of Peak Electron Flux Rate	
89	0–8		15th Pair of Peak Electron Flux Rate	I
89	9–17			
89	18–35		Blank	
90	0–8		1st Proton Angular Distribution	I
	9–17		2nd Proton Angular Distribution	
	18–26		3rd Proton Angular Distribution	
	27–35		4th Proton Angular Distribution	
91 – 105			Same as Word 90 for 5th thru 64th Proton Angular Distribution	I
106	0–8		1st Alpha Particle Angular Dist.	I
	9–17		2nd Alpha Particle Angular Dist.	
	18–26		3rd Alpha Particle Angular Dist.	
	27–35		4th Alpha Particle Angular Dist.	
107 – 121			Same as Word 106 for 5th thru 64th Alpha Particle Angular Distribution	
122	0–1		Data Quality, 1st TRW Word (Word is 8-bit Tele Sample)	I
	2–3		Data Quality, 2nd TRW Word	
	4–5		Data Quality, 3rd TRW Word	
	6–7		Data Quality, 4th TRW Word	
	8–9		Data Quality, 5th TRW Word	
	10–11		Data Quality, 6th TRW Word	
	12–13		Data Quality, 7th TRW Word	
	14–15		Data Quality, 8th TRW Word	
	16–17		Data Quality, 9th TRW Word	
	18–19		Data Quality, 10th TRW Word	
	20–21		Data Quality, 11th TRW Word	
	22–23		Data Quality, 12th TRW Word	

VORD #	BITS	UNITS	IDENTIFICATION.	FORMAT
	24–25		Data Quality, 13th TRW Word	
	26–27		Data Quality, 14th TRW Word	
	28–29		Data Quality, 15th TRW Word	
	30–31		Data Quality, 16th TRW Word	
	32–33		Data Quality, 17th TRW Word	
	34–35		Data Quality, 18th TRW Word	
123			Data Quality for 19th thru 36th TRW Words	I
124			Data Quality for 37th thru 54th TRW Words	
125			Data Quality for 55th thru 72nd TRW Words	
126			Data Quality for 73rd thru 90th TRW Words	
127			Data Quality for 91st thru 108th TRW Words	
128			Data Quality for 109th thru 126th TRW Words	
129			Data Quality for 127th thru 144th TRW Words	
130			Data Quality for 145th thru 162nd TRW Words	
131			Data Quality for 163rd thru 180th TRW Words	
132			Data Quality for 181st thru 198th TRW Words	
133			Data Quality for 199th thru 216th TRW Words	
134			Data Quality for 217th thru 230th TRW Words (The last 8-bits of Word 134 are blank)	
135			VO 1 - Step Number	
136			VO 2 - Step Number	
137			VO 3 - Step Number	
138			Background	

I

VQRD #	BITS	UNITS	IDENTIFICATION	FORMAT
139 ↓ 170			32 Calibrated Peak Positive Ion Flux Rates	
171 ↓ 185			14 Calibrated Peak Electron Ion Flux Rates	F
186 ↓ 249			64 Calibrated Proton Angular Distribution	F
250 ↓ 313			64 Calibrated Alpha Particle Angular Distribution	F
314		Degrees	OA Scan	F
315		msecs	OA 1	F
316		msecs	OA 2	F
317		msecs	OA 3	F
318		msecs	OA 4	F
319 ↓ 393			Same as Words 314-318 for Seq. 2-16 of TRW Cycle	F
394		Days	Day of Orbit Data	I
395		msecs	Milliseconds of Day	I
396		Degrees	Longitude } Satellite Position in Geocentric Coordinates	F
397		Degrees	Latitude } Satellite Position in Geocentric Coordinates	F
398		Degrees	Longitude } Satellite Position in Geomagnetic Coordinates	F
399		Degrees	Latitude } Satellite Position in Geomagnetic Coordinates	F
400		Kms	Radial Distance from the Center of Earth to Satellite	F
401		Kms	X } Satellite Position in Solar Ecliptic Coordinates (E. R.)	F
402		Kms		F
403		Kms	Z	F
404			X } Solar Ecliptic Coordinates of Theoretical Geomagnetic Field	F
405				F
406			Z	F
407		Kms/Sec	Magnitude of Velocity	F

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
408		Degrees	Right Ascension } Inertial Ecliptic	F
409		Degrees	Declination } Satellite Position	F
410		Earth Radii	L = Mc Ilwain Parameter } Real Field Coordinate	F
411		Gamma	B = Field Strength } System	F
412		Degrees	Satellite-Earth-Sun Angle (L_{SEP})	F
413		Kms	X } Satellite Position in Geocentric	F
414		Kms	} Solar Magnetospheric Coordinates	F
415		Kms	Z	F
416		Degrees	Longitude } Sub-Solar Point in	F
417		Degrees	Latitude } Geomagnetic Coordinates	F

COMMENTS: This data will be written in binary on a 7-track, 800 BPI density tape, such that it may be read on a IBM 7090 by a FORTRAN read (I) list statement. In the "Format" Column, "I" represents a 36-bit integer and "F" represents an IBM 7090 36-bit floating point number.

4.5.7 APL/GSFC Experimenter Tape Format

Experimenter I. D. : 07 5/9/67

WORD #	BYTES	UNITS	IDENTIFICATION	FORMAT
1			Control Word.	
2	4	Days	Day of Frame 0, Channel 0, Seq. 1	I
3	4	msecs	Milliseconds of Frame 0, Channel 0, Sequence 1	I
4	1		Time Quality Flag (Sequence 1)	I
5	1		Data Quality Flag for Channel 15b	I
6	1		Data Quality Flag for Channel 15a	I
7	1		Data Quality Flag for Channel 14b	I
8	1		Data Quality Flag for Channel 14a	I
9	4	counts	Detector 4A (Channels 14, 15, Frame 0)	I
10	1		Pseudo-Sequence Count Quality Flag	I
11	4	counts	Pseudo-Sequence Count	I
12	1		Sequence I. D. Quality	I
13	1	counts	Sequence I. D. (Sequence 1)	I
14	4		Satellite Clock	I
15	4	Volts	PP7 (+11.7 volt line)	F
16	4	Degrees	PP17 (STL temperature, near APL experiment)	F
17	4	Days	Day of Frame 0, Channel 0, Sequence 2	I
18	1	msecs	Milliseconds of Frame 0, Channel 0, Sequence 2	I
19	1		Time Quality Flag (Sequence 2)	I
20	1		Data Quality Flag for Channel 15b	I
21	1		Data Quality Flag for Channel 15a	I
22	1		Data Quality Flag for Channel 14b	I
23	1		Data Quality Flag for Channel 14a	I
24	4	counts	Detector 4B (Channels 14, 15, Frame 0)	I
25	1		Pseudo-Sequence Count Quality Flzg	I
26	4	counts	Pseudo-Sequence Count	I
27	1		Sequence I. D. Quality Flag	I
28	1	counts	Sequence I. D. (Sequence 2)	I
29	4		Satellite Clock	I

VORD #	BYTES	UNITS	IDENTIFICATION	FORMAT
30	4	Volts	PP 7 (+11.7 volt line)	F
31	4	Days	Day of Frame 0, Channel 0, Sequence 3	I
32	4	msecs	Milliseconds of Day, Frame 0, Channel 0	I
33	1		Time Quality Flag (Sequence 3)	I
34	1		Data Quality Flag for Channel 15b	I
35	1		Data Quality Flag for Channel 15a	I
36	1		Data Quality Flag for Channel 14b	I
37	1		Data Quality Flag for Channel 14a	I
38	4	Counts	Detector 3 (Channels 14, 15, Frame 0)	I
39	1		Pseudo-Sequence Count Quality Flag	I
40	4	counts	Pseudo-Sequence Count	I
41	1		Sequence I. D. Quality Flag	I
42	1		Sequence I. D. (Sequence 3)	I
43	4		Satellite Clock	I
44	4	Volts	PP 7 (Sequence 3)	F
45	4	Degrees	PP 17 (BTL temperature, near APL experiment)	F
46	4	Days	Day of Frame 0, Channel 0, Sequence 4	I
47	4	msecs	Milliseconds of Frame 0, Channel 0	I
48	1		Time Quality Flag (Sequence 4)	I
49	1		Data Quality Flag, Channel 15b	I
50	1		Data Quality Flag, Channel 15a	I
51	1		Data Quality Flag, Channel 14b	I
52	1		Data Quality Flag, Channel 14a	I
53	4	counts	Detector 2 (Channels 14, 15, Frame 0)	I
54	1		Pseudo-Sequence Count Quality Flag	I
55	4	counts	Pseudo-Sequence Count	I
56	1		Sequence I. D. Quality Flag	I
57	1	counts	Sequence I. D. (Sequence 4)	I
58	4		Satellite Clock	I
59	4	Volts	PP 7 (Sequence 4)	F

WORD #	BYTES	UNITS	IDENTIFICATION	FORMAT
60-117			Four more sequences of data (Items 2-59 repeated once)	
118			On/Off flags all 8 sequences	
119	4	Days	Day of Orbit Data	F
120	4	msecs	Milliseconds of Day	F
121	4	Degrees	Geocentric Longitude Satellite Position	F
122	4	Degrees	Geocentric Latitude Satellite Position	F
123	4	Kilometers	Radial Distance From Center of Earth	F
124	4	Kms	X Solar Ecliptic Satellite Position	F
125	4	Kms	Y Solar Ecliptic Satellite Position	F
126	4	Kms	Z Solar Ecliptic Satellite Position	F
127	4	Kms/Sec	Magnitude of Velocity	F
128	4	Earth Radii	R_o Geomagnetic Coordinate	F
129	4	Degrees	Latitude Geomagnetic Coordinate	F
130	4	Earth Radii	L = Mc Ilwain magnetic shell radius	F
131	4	Gamma	B = Magnetic Field Strength	F
132	4		B/B_o	F
133	4	Degrees	L_{SEP} (Sun-Earth-Probe angle)	F
134	4	Kms	X Solar Magnetosphere Satellite Position	F
135	4	Kms	Y Solar Magnetosphere Satellite Position	F
136	4	Kms	Z Solar Magnetosphere Satellite Position	F

This is a 7-track, 800 BPI, binary mode tape. There is a four-byte control word at the beginning of each record. Byte 1 contains a "1". Bytes 2, 3, and 4 contain the number of bytes in the logical record (545_{10}). All words are in IBM 360 notation. Experiment synchronization will be maintained by the decommutation program on the UNIVAC 1108.

4.5.8 GSFC/University of Maryland Experimenter Tape Format

Experimenter I. D. : 08 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1		Days	Days of Frame 0, Channel 0	I3
2		msecs	Milliseconds of Day of Frame 0, Channel 0	I8
3			Time Quality Flags	I1
4		counts	Channel 1-a	I2
5			Data Quality Flag, 1-a	I1
6		counts	Channel 1-b	I2
7			Data Quality Flag, Channel 1-b	I1
8-47			Data and Associated Quality Flags for Channels 2-a thru Channel 11-b	20 (I2, I1)
48		counts	Channel 12-a	I1
49			Data Quality Flag, Channel 12-a	I1
50		counts	Channel 12-b	I1
51		Counts	Channel 12-c	I1
52		counts	Channel 12-d	I1
53		Counts	Channel 13-a	I1
54			Data Quality Flag, Channel 13	I1
55		Counts	Channel 13-b	I1
56		counts	Pseudo-Sequence Count	I7
57			Pseudo-Sequence Count Quality Flag	I2
58		Counts	Sequence I. D.	I2
59			Sequence I. D. Quality Flag	I1
60		counts	Satellite Clock	I5
61		Degrees	PP17 (BTL Temperature)	F6.1
62		Degrees	Optical Aspect Scan (Spin Axis-Sun Angle)	F6.2
63		msecs	Optical Aspect 1 (Sun Time)	F5.0
64		msecs	Optical Aspect 2 (Spin Period)	F6.0
65		msecs	Optical Aspect 3 (Earth Time)	F6.0
66		msecs	Optical Aspect 4 (Earth Width)	F5.0
67-198			Data from two more sequencies (Items 1-66 repeated twice)	
199		Days	Day of Orbit data	I3

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
200		msecs	Milliseconds of Day of Orbit Data	I8
201		Degrees	Geocentric Longitude	F8.3
202		Degrees	Geocentric Latitude	F7.3
203		Kms	Radial Distance From Center of Earth	F10.3
204		Degrees	Right Ascension of the Velocity Vector	F7.3
205		Degrees	Declination of the Velocity Vector	F7.3
206		Kms/Sec	Magnitude of the Velocity	F9.3
207		Earth Radii	R_o = Geomagnetic Coordinate	F10.3
208		Degrees	Geomagnetic Latitude	F7.3
209		Earth Radii	L = Mc Ilwain magnetic shell radius	F7.3
210		Gamma	B = Magnetic Field Strength	F10.4
211			B/B_o = Ratio of the Magnetic Field Strength	F10.4
212		Degrees	Right Ascension (of the magnetic vector)	F5.1
213		Degrees	Declination (of the magnetic vector in celestial inertial)	F5. 1
214		Kms	X Solar Ecliptic Coordinates	F11.3
215		Kms	Y Solar Ecliptic Coordinates	F11.3
216		Kms	Z Solar Ecliptic Coordinates	F11.3
217		Kms	X Geocentric Equatorial Inertial Coordinates	F11.3
218		Kms	Y Geocentric Equatorial Inertial Coordinates	F11.3
219		Kms	Z Geocentric Equatorial Inertial Coordinates	F11.3

This tape is a seven-track, BCD tape, written in 800-BPI density. The BCD will be standard 6-bit external code. Any field with all 9's (I2 = 99, or I1 = 9, etc.) indicates missing data. January 1 is equal to day zero for the day count.

The following FORMAT statement was used to write this data.

```
5  FORMAT (3(I3,I8,22(I1,I2),9I1,I7,2I2,I1,I5/F6.1,F6.2,F5.0,2F6.0,1F5.0/)I3,
   18,F8.3,F7.3,F18.3,2F7.3,F9.3,F10.3,2F7.3,2F10.4,/,22F5.1,6F11.3)
```

4.5.9 GSFC/Dr. Hagge Experimenter Tape Format

Experimenter I. D. : 09 5/9/67

VORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1	32		Control Word	
2	16	counts	Satellite Clock	I
2	16	Days	Day of Frame 0, Channel 0	I
3	32	msecs	Milliseconds of Frame 0, Channel 0	I
4	32		Quality Flags this sequence	I
5	16	Counts	Sequence I. D. Quality Flag	I
5	16		Sequence I. D.	I
6	8		Pseudo-Sequence Count Quality	I
6	24	counts	Pseudo-Sequence Count	I
7	16	counts	Frame 1, $6a_1$	I
7	16	Counts	Frame 1, $6b_1$	I
8	16	Counts	Frame 1, $6c_1$	I
8	16	Counts	Frame 1, $6d_1$	I
9	32	Counts	Frame 1, $6e_1$	I
10	16	counts	Frame 5, $6a_2$	I
10	16	Counts	Frame 5, $6b_2$	I
11	16	counts	Frame 5, $6c_2$	I
11	16	Counts	Frame 5, $6d_2$	I
12	32	counts	Frame 5, $6e_2$	I
13	16	counts	Frame 9, $6a_1$	I
13	16	Counts	Frame 9, $6b_1$	I
14	16	Counts	Frame 9, $6c_1$	I
14	16	Counts	Frame 9, $6d_1$	I
15	32	Counts	Frame 9, $6e_1$	I
16	16	counts	Frame 13, $6a_2$	I
16	16	Counts	Frame 13, 6bz	I
17	16	counts	Frame 13, $6c_2$	I
17	16	counts	Frame 13, $6d_2$	I
18	32	counts	Frame 13, $6e_2$	I
19-137			Data from seven more sequences (Items 2-18 repeated seven times)	

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
138	32	Degrees	PP16, transmitter temperature, average for 8 sequences	F
139	32	Degrees	PP17, BTL temperature, average for 8 sequences	F
140	32	Degrees	PP19, Pre-boost regulator temperature, average for 8 sequences	F
141	32	Degrees	OA Scan (spin axis-sun-angle from sequence 1)	F
142	32	Millisecs	OA 1 (sun time fram frame 0, channel 0 of sequence 1)	F
143	32	Millisecs	OA 2 (spin period from sequence 1)	F
144	32	Days	Day of Orbit Data	I
145	32	Millisecs	Milliseconds of Day of Orbit Data	I
146	32	Kms	X Celestial Inertial Satellite Position	F
147	32	Kms	Y Celestial Inertial Satellite Position	F
148	32	Kms	Z Celestial Inertial Satellite Position	F
149	32	Kms	X Solar Ecliptic Satellite Position	F
150	32	Kms	Y Solar Ecliptic Satellite Position	F
151	32	Kms	Z Solar Ecliptic Satellite Position	F
152	32	Kms	X Solar Magnetosphere Satellite Position	F
153	32	Kms	Y Solar Magnetosphere Satellite Position	F
154	32	Kms	Z Solar Magnetosphere Satellite Position	F
155	32	Degrees	Geomagnetic Latitude Satellite Position	F
156	32	Degrees	Geomagnetic Longitude Satellite Position	F
157	32	Kms	Radial Distance, Center of the Earth to the Satellite	F
158	32	re	L=Mc Ilwain Magnetic Shell Radius	F
159	32	Gamma	B=Magnetic Field Strength	F
160	32		B/Bo	
161	32	Degrees	Geomagnetic Latitude Sun Position	F
162	32	Degrees	Geomagnetic Longitude Sun Position	F

This is a binary mode, seven-track, 800-BPI tape written in IBM 360 format. There will be a 4-byte (8 bits per byte) control word at the beginning of each record. Byte 1 of the control word contains a "1". Bytes 2, 3, 4 contain the number of bytes in the logical record (648 bytes). In this case the logical record contains one physical record. Missing data will be indicated by all bits set to "1". Experiment synchronization will be maintained by the decommutation program on the Univac 1108.

4.5.10 Optical Aspect/Performance Parameter Experimenter Tape Format

Experimenter I. D. : 10 5/9/67

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
1		Days	Day of Frame 0, Channel 0	I
2		Hours	Hour of Frame 0, Channel 0	I
3		Minutes	Minutes of Frame 0, Channel 0	I
4		msecs	Milliseconds of Frame 0, Channel 0	I
5			Satellite Clock	I
6		Counts	Sequence I. D.	I
7		counts	Pseudo-Sequence Count	I
8		Counts	Orbit Number	I
9		Volts	PP 1 (STL volts)	F
10		volts	PP 2 (SUI LEPEDEA)	F
11		Amps	PP 3 (Paddle Current)	F
12		Volts	PP 4 (Battery Volts)	F
13		Amps	PP 5 (Battery Current)	F
14		Amps	PP 6 (SC Current)	F
15		Volts	PP 7 (+11.7 volt line)	F
16		Volts	PP 8 (+28 volt line)	F
17		Volts	PP 9 (BTL bias volts)	F
18		Volts	PP 10 (MOST volts)	F
19		Degrees or Volts	PP 11 (RADEM)	F
20		Volts	PP 12 (CHI volts)	F
21		Degrees	PP 13, PP 21	F
22		Degrees	PP 14, PP 22	F
23		Degrees	PP 15, PP 23	F
24		Degrees	PP 16, PP 24	F
25		Degrees	PP 17, PP 25	F
26		Degrees	PP 18, PP 26	F
27		Degrees or Volts	PP 19, PP 27	F
28		Degrees	PP 20, PP 28	F
29		Degrees	OA SCAN (spin axis sun angle)	F
30		msecs	OA 1 (sun time)	I

JORD #	BITS	UNITS	IDENTIFICATION	FORMAT
31		msecs	OA 2 (spin period)	I
32		msecs	OA 3 (earth time)	I
33		msecs	OA 4 (earth width)	I
34		counts	Encoder Calibration (Channel 1, Frame 4)	I
35			Univ. of Calif. On/Off Flag	I
36			SCAS On/Off Flag	I
37			Univ. of Md. On/Off Flag	I
38			TRW On/Off Flag	I
39			Univ. of Iowa On/Off Flag	I
40			Univ. of Chicago On/Off Flag	I
41			CRT On/Off Flag	I
42			BTL/SEP On/Off Flag	I
43			MAG On/Off Flag	I
44			OA On/Off Flag	I
45			APL On/Off Flag	I
46			Heater On/Off Flag	I
47			Flipper Position	I
48			Mag Up	I
49			Mag Down	I
50			F/G Calibration On/Off Flag	I

This is a seven-track, 556-BPI, binary mode tape. Each item is 36 bits. PP13-PP2 will appear on even sequences, and PP21-PP28 will appear on odd sequences.

"I" and "F" in the FORMAT column indicate integer and floating point, respectively, UNIVAC 1108 notation. Negative numbers are denoted by the 1's complement of the positive value.

4.5.11 Dr. Ness/Magnetic Field Experimenter Tape Format

Experimenter I. D. : 11 5/9/67

VQRD #	BITS	UNITS	IDENTIFICATION	FORMAT
1			Control Word	I
2		counts	Satellite I. D.	I
3		Counts	Acquisition Station I. D.	I
4		Counts	Analog Tape I.D.	I
5		Counts	Analog-to-Digital Line Indicator	I
6		Year	Year of Frame 0, Channel 0	I
7		Days	Day of Frame 0, Channel 0	I
8		msecs	Milliseconds of Day	I
9			Time Quality Flag	I
10			Data Quality Flag for this sequence	I
11			Experiment On/Off Flags	I
12			Orbit Data Flag	I
13		Counts	Analog Calibration (Channel 1, Frame 4)	I
14			Pseudo-Sequence Count Quality Flag	I
15		Counts	Pseudo-Sequence Count	I
16			Sequence I. D. Quality Flag	I
17		Counts	Sequence I. D.	I
18			Satellite Clock	I
19		msecs	Average Frame Time in Milliseconds	I
20		Degrees	PP 21 (Bellows temperature)	F
21		Volts	PP 7 (+11. 7 volt line)	F
22			Frame Number (1)	I
23		Counts	Mag X	I
24		counts	Mag Y	I
25		counts	Mag Z	I
26			Frame Number (3)	I
27		Counts	Mag X	I
28		counts	Mag Y	I
29		counts	Mag Z	I
30-53		counts	Magnetometer values for Frames 5, 7, 9, 11, 13, and 15 (Items 26-29 repeated six times)	

/ORD #	BITS	UNITS	IDENTIFICATION	FORMAT
54		Counts	Frame 8, Channel la, lb, 2a	I
55		counts	Frame 8, Channel 2b	I
56		counts	Frame 8, Channel 3a, 3b	I
57		counts	Frame 8, Channel 4a	I
58		Counts	Frame **8,** Channel 4b, 5a	I
59		Counts	Frame 8, Channel 5b	I
60		Counts	Frame 8, Channel 6a, 6b	I
61		counts	Frame 8, Channel 7a	I
62		Counts	Frame 8, Channel 7b, 8a	I
63		counts	Frame 8, Channel 8b	I
64		counts	Frame 8, Channel 9a, 9b	I
65		Counts	Frame 8, Channel 10a	I
66		Counts	Frame 8, Channel 10b, 11a	I
67		counts	Frame 8, Channel-llb	I
68		Counts	Frame 8, Channel 12a, 12b	I
69		counts	Frame 8, Channel 13a	I
70		Counts	Frame 8, Channel 13b, 14a	I
71		Counts	Frame 8, Channel 14b	I
72		Counts	Frame 8, Channel 15a, 15b	I
73		Degrees	OA SCAN (spin-axis-sun-angle)	F
74		msecs	OA 1 (Sun Time)	F
75		msecs	OA 2 (Spin Period)	F
76		msecs	OA 3 (Earth Time)	F
77		msecs	OA 4 (Earth Width)	F
78-229			Data for two more telemetry sequences (Items 2-77 repeated twice)	
230		Days	Day of Orbit Data	I
231		msecs	Milliseconds of Day of Orbit Data	I
232		Degrees	Geomagnetic Latitude Satellite Position	F
233		Degrees	Geomagnetic Longitude Satellite Position	F
234		Kms	X Solar Ecliptic Satellite Position	F
235		Kms	*Y* Solar Ecliptic Satellite Position	F

WORD #	BITS	UNITS	IDENTIFICATION	FORMAT
236		Kms	Z Solar Ecliptic Satellite Position	F
237		Kms	Radial Distance to Satellite from Earth's Center	F
238		Kms	X Solar Magnetosphere Satellite Position	F
239		Kms	Y Solar Magnetosphere Satellite Position	F
240		Kms	Z Solar Magnetosphere Satellite Position	F
241		Kms	X Solar Ecliptic Moon Position	F
242		Kms	Y Solar Ecliptic Moon Position	F
243		Kms	Z Solar Ecliptic Moon Position	F
244		Kms	X Solar Magnetosphere Moon Position	F
245		Kms	Y Solar Magnetosphere Moon Position	F
246		Kms	Z Solar Magnetosphere Moon Position	F
247		Kms	Distance from Satellite to Moon	F
248		Kms	Distance From Satellite to the Moon Which is Parallel to the X Axis	F
249		Degrees	Geomagnetic Latitude Sun Position	F
250		Degrees	Geomagnetic Longitude Sun Position	F
251			X Theoretical Geomagnetic Field in Solar Ecliptic	F
252			Y Theoretical Geomagnetic Field in Solar Ecliptic	F
253			Z Theoretical Geomagnetic Field in Solar Ecliptic	F
254		Gamma	Magnitude of the Theoretical Geomagnetic Field in Solar Ecliptic	F
255-263			Rotation Matrix from Solar Ecliptic to Solar Magnetic	F
264-272			Rotation Matrix from Celestial Inertial to Solar Ecliptic	F
273		Degrees	Geocentric Latitude Satellite Position	F
274		Degrees	Geocentric Longitude Satellite Position	F

This is a seven-track, 556-BPI, binary mode tape. All items (both integer and floating) are 32-bit, IBM 360 notation words. One four-byte control word (which gives the number of bytes in the logical record) is at the beginning of each record. Missing data is indicated by having all bits except sign bit set to "1".

4.5.12 Radiation Damage Experimenter Tape Format

Experimenter I. D. : 12 5/9/67

ITEM #	BITS	UNITS	IDENTIFICATION	FORMAT
1		Days	Day of Frame 0, Channel 0	I3
2		Hours	Hours of Frame 0, Channel 0	I2
3		Minutes	Minutes of Frame 9, Channel 0	I2
4		Millisecs	Seconds of Frame 0, Channel 0	I5
5			Time Quality Flag	I1
6		Counts	Pseudo-Sequence Count	I7
7			Pseudo-Sequence Count Quality Flag	I2
8		Counts	Sequence I. D.	I2
9			Sequence I. D. Quality Flags	I1
10		Counts	Satellite Clock	I5
11		Volts	PP 10 (Channel 13, Frame 4)	F7.2
12		Volts/Deg	PP 11 (Channel 14, Frame 4)	F7.2
13-192			Data from 15 more sequences (Items 1-12 repeated 15 times)	

TOTAL BCD CHARACTERS/BLOCK

This tape is a 7-track 800 BPI, BCD tape. The BCD is standard 6-bit external code. Missing data will be indicated by 9's throughout the field.

The following FORMAT statement was used to write this data.

```
11 FORMAT(I5(I3, 2I2, I5, I1, I7, 2I2, I1, I5, 2F7. 2, /), I3, 2I2, I5, I1, I7, 2I2, 1I1, I5, 2F7. 2)
```

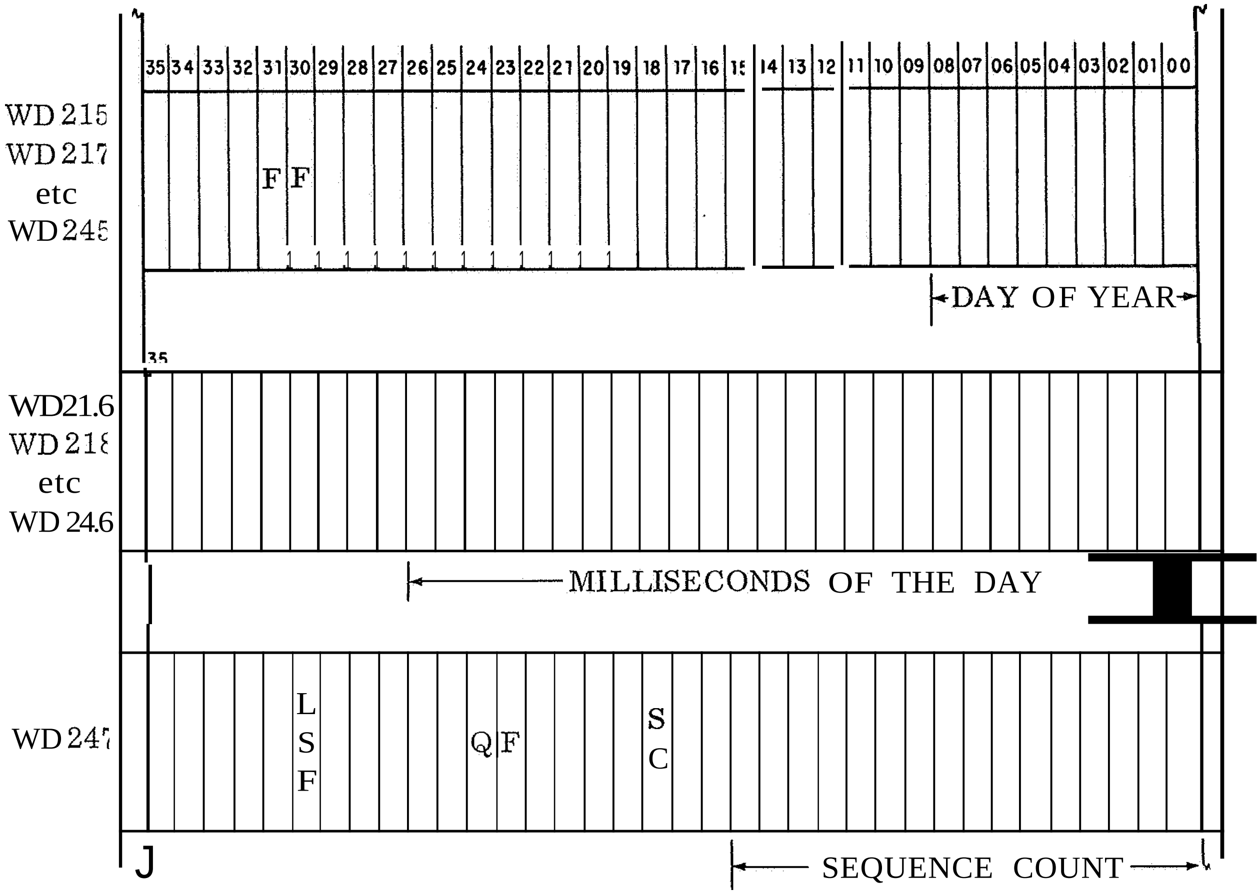
3

4.6 MASTER DATA TAPE FORMAT - 1108 RECORD

	35 34 33 32 31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12	11 10 09 08 07 06 05 04 03 02 01 00
WD 1	W1	W2	W3
WD 2	W4	A T	A T
WD 3	FR. NO.	CH. NO.	
• •	WORDS 4 THROUGH 212		
WD 213	D.S. 29 16TH FR.	D.S. 30 16TH FR.	D.S. 31 16TH FR.
WD 214	D.S. 32 16TH FR.	FILL	FILL
WD 215			
WD 216	1ST FRAME MILLISEC OF DAY		
• •	WORDS 217 THROUGH 244		
WD 245	16TH FRAME DAY OF YEAR		
WD 246	16TH FRAME MILLISEC OF DAY		
WD 247	SEQUENCE COUNT		
WD 248	FLAGS		
WD 249	FLAGS	SEQUENCE I.D.	
WD 250	SATELLITE CLOCK		

Words 1 through 214 are data from intermediate data tape. Words 215 through 250 are corrected frame times. Odd numbered words 215 through 245 contain day of year. Even numbered words 216 through 246 contain milliseconds of day.

1108 RECORD (continued)



Quality Flags for Data from Intermediate Data Tape: QF = 11 Good Data
10 Fair Data
01 Poor Data
00 Undetermined

All Odd Numbered Words from 215 to 245, Bits 30 & 31 Time Flag:

FF = 00 Time OK
01 Time OK but was altered
10 Time Bad
11 Time Correction bypassed

Word 247: <u>Bit No.</u>

18 0 = SC OK
1 = SC was modified
23–24 QF (2-bit Quality Flag)
30 LSF (Loss of Sync Flag)
0 = Sync OK
1 = Sync Loss

PRODUCTION **AND**

OPERATIONS PROCEDURES

5. IMP-F PRODUCTION AND OPERATIONS PROCEDURES

Figure V-1 shows the Operations Plan for processing data received from the Interplanetary Monitoring Platform (IMP-F) Spacecraft. The STARS II F-9 Processor Line and the 3200 Computer furnish data on a quick-look basis. The Production Control Center accumulates, evaluates, and furnishes an account of all incoming analog tapes from the STADAN tracking stations, processes the data and ships to each experimenter his particular decommutated tape or print.

A brief description of the various functional groups shown on the Operations Plan follows:

1. Analog Library (AL)

   a. Receives analog tapes from the STADAN tracking stations.

   b. Catalogs and files analog tapes.

   c. Sends tape-logs to Analog Accounting.

   d. Dispatches analog tapes upon request from the Production Control Center (PCC).

   e. Receives analog tapes processed by the computer and files them.

2. Analog Accounting Library (AAL)

   a. Receives buffer logs and teletype reports.

   b. Code 1 cards punched from the logs and reports.

   c. Keeps a chronologically up-dated file of all the processing through shipment of each analog tape received.

   d. Sends to PCC, daily, a report of each IMP-F analog tape received.

   e. Supplies the following groups with a chronological listing:

      1. PCC
      2. DPE
      3. DPS
      4. DATA INSPECTION

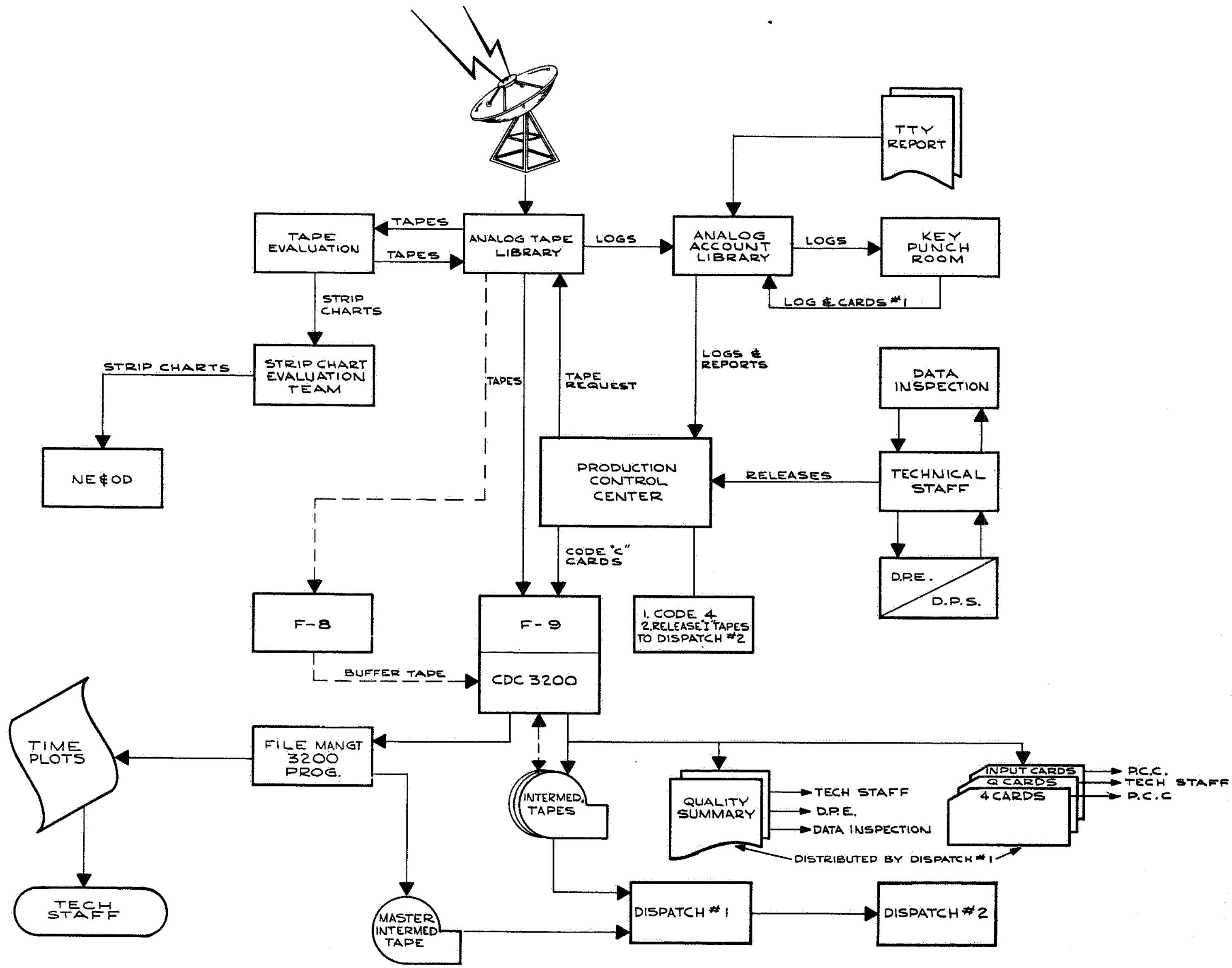


Figure V-1. IMP-F Operations Plan

3. Production Control (PCC)

a. Receives from the AAL lists of analog tapes received plus a copy of teletype reports.

b. Accumulates an orbit of files and sends requests for them to be processed on the F-9 Line with the F-8 as a back-up.

c. Sets up lists for punching Code C cards (See Figure V-2).

d. Submits Quick-look Data
   (1) 6 hours of data twice per week

e. Requests all analog tapes to be strip-charted for the first 2 months after launch, after which a random selection will be established.

f. Receives from the Technical Staff a list of all files processed, deleted, or that are unprocessable.

g. Releases Intermediate or Master Intermediate Tapes and Code 4 cards (See Figure V-3) from Dispatch #1 to Dispatch #2 after receiving OK from Technical Staff.

h. See Figures V-5 through V-11 for the forms used by PCC.

4. Tape Evaluation

a. Strip-charts all tapes requested for the following:

   1. Drift
   2. Peak Flutter
   3. Signal Plus Noise
   4. Detected Sync Pulse
   5. AGC

5. Technical Staff (TS)

a. Sets the criteria and the format to be used by the Data Inspectors.

b. Furnishes the DPE, DPS, and PCC with pertinent information regarding data inspection.

c. Analyzes the telemetry data by means of special programs and reports findings to the Project Office.

COLUNIN	IDENTIFICATION	
1-4	SATELLITE I.D.	
5-7	STATION I. D.	
8	ANALOG FILE NUNIBER	
9-12	ANALOG TAPE NUMBER	
13	YEAR	RECORD DATE
14-15	MONTH	
16-17	DAY	
18-22	BUFFER TAPE NUMBER	
23-26	ORBIT (PASS) NUMBER	
27-30	UNUSED	
31-32	INTERMEDIATE TAPE NUMBER	
33	UNUSED	
34-35	HOURS	ANALOG START TIME
36-37	MINUTES	
38-39	SECONDS	
40	UNUSED	
41-42	HOURS	ANALOG STOP TIME
43-44	MINUTES	
45-46	SECONDS	
47	UNUSED	
48	YEAR	RECEIVED DATE
49-50	MONTH	
51-52	DAY	
53-55	UNUSED	
56-57	YEAR	EVALUATION DATE
58-59	MONTH	
60-61	DAY	
*62	ANALOG-TO-DIGITAL LINE I.D.	
63	PROCESS NUMBER	
64-73	TAPE UNIT RECORDING NUMBER	
74-79	UNUSED	
80	CARD I.D. (CODE C)	

*Analog-to-Digital Line Code is: F-9=1, F-8=2.

Figure V-2. Code C Card Input to CDC 3200 Computer

COLUMN	IDENTIFICATION
1–4	SATELLITE I.D. (IMP–F)
5–7	STATION I.D.
8–11	ANALOG TAPE NUMBER
12–13	ANALOG FILE NUMBER
14–19	RECORD DATE
20	UNUSED
21–24	ORBIT (PASS) NUMBER
25	UNUSED
26–29	EDIT NUMBER
30	UNUSED
31–32	EDIT FILE NUMBER
33	UNUSED
34–39	EDIT START TIME (HR., MIN., SEC.)
40	UNUSED
41–46	EDIT STOP TIME (HR., MIN., SEC.)
47	UNUSED
48–52	BUFFER TAPE NUMBER (F–8 LINE)
53–55	UNUSED
56–60	DIGITIZED DATE
61	UNUSED
62–66	MERGE DATA
67–79	UNUSED
80	CARD IDENTITY (C)

Figure V-3. Code 4 Card Output of 3200 Program

6. Data Inspection

   a. Examines and evaluates the Quality Summaries of the Analog/ Digital IMP-F On-Line Processing Programs.

   b. Sends reports to the Technical Staff.

   c. Sets up and submits Task Cards so that the Master Intermediate Tapes can be made by using the File Management Program, when necessary.

   d. Files the Quality Summary Sheets for future reference.

7. STARS Phase II Operation

   a. Performs Analog-to-Digital processing on the F-9 Line with output via the CDC **3200** Computer (See Figure V-4).

8. File Management Program

   a. Merges out-of-order files on the Intermediate Tapes onto a Master Intermediate Tape in chronological order.

   b. Used to produce on-line time plots.

   c. Checks output tapes for I. D.'s and End-of-Files.

9. Forms used by Production Control

   a. Figure V-5 shows the tape numbering system in use. The Intermediate tapes and the Master tape are labeled with a brown and white plastic tape label as soon as the reels come off the computer.

   b. Figure V-6 shows the General Purpose Data Sheet, in this case used for the Code 4 Accounting Card format.

   c. Figure V-7 shows the form used for logging Intermediate tapes.

   d. Figure V-8 shows the form used by Production Control to order tapes from the Analog Library.

   e. Figure V-9 shows the form used by Production Control to update the accounting program with good files.

   f. Figure V-10 shows the form used by Production Control to send rejected and deleted files to the Accounting Office.

   g. Figure V-11 shows the form used by Production Control to log the Intermediate tapes.

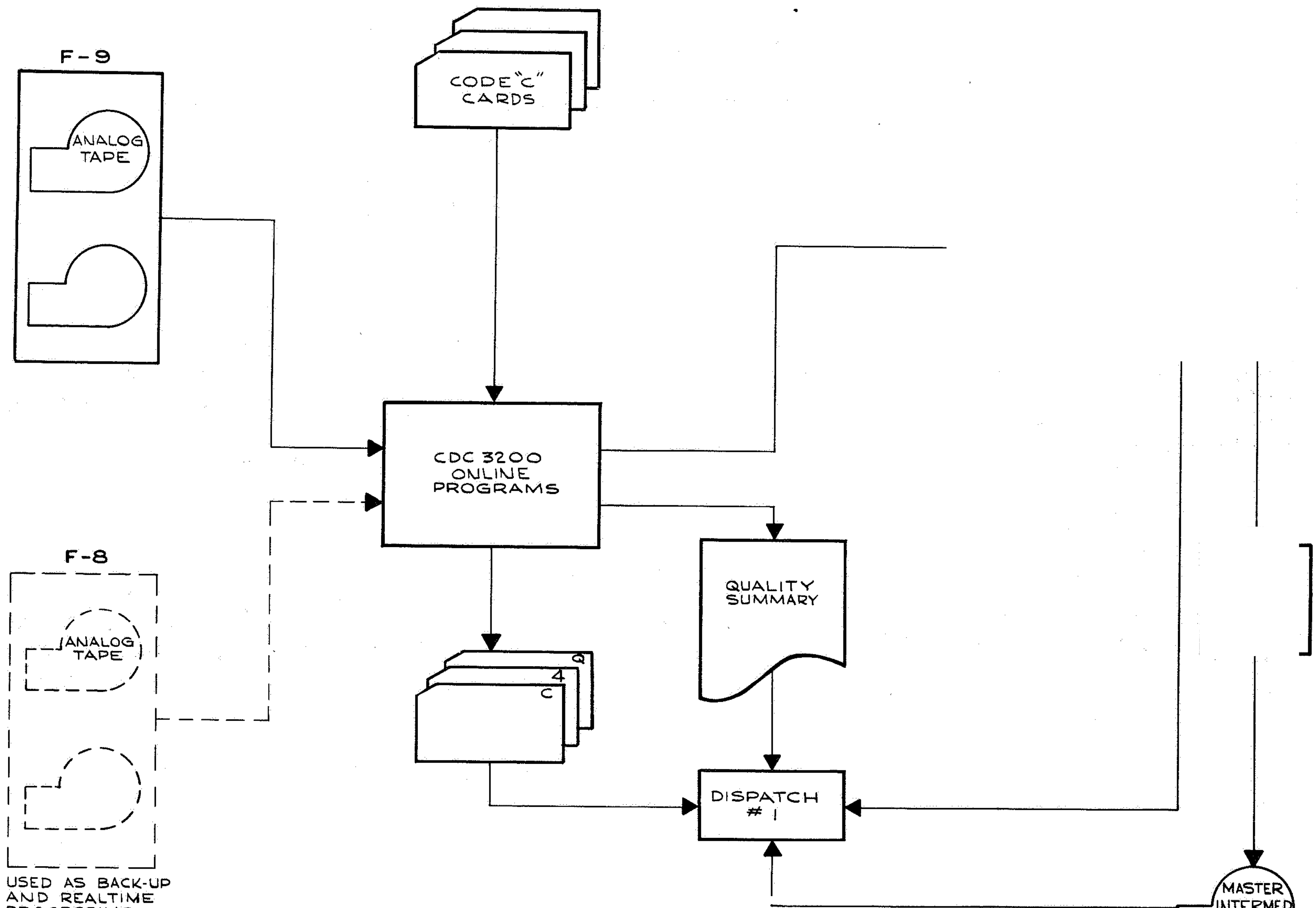


FIG. V-4
STARS PHASE II OPERATION

Figure V-4. STARS Phase II Operation

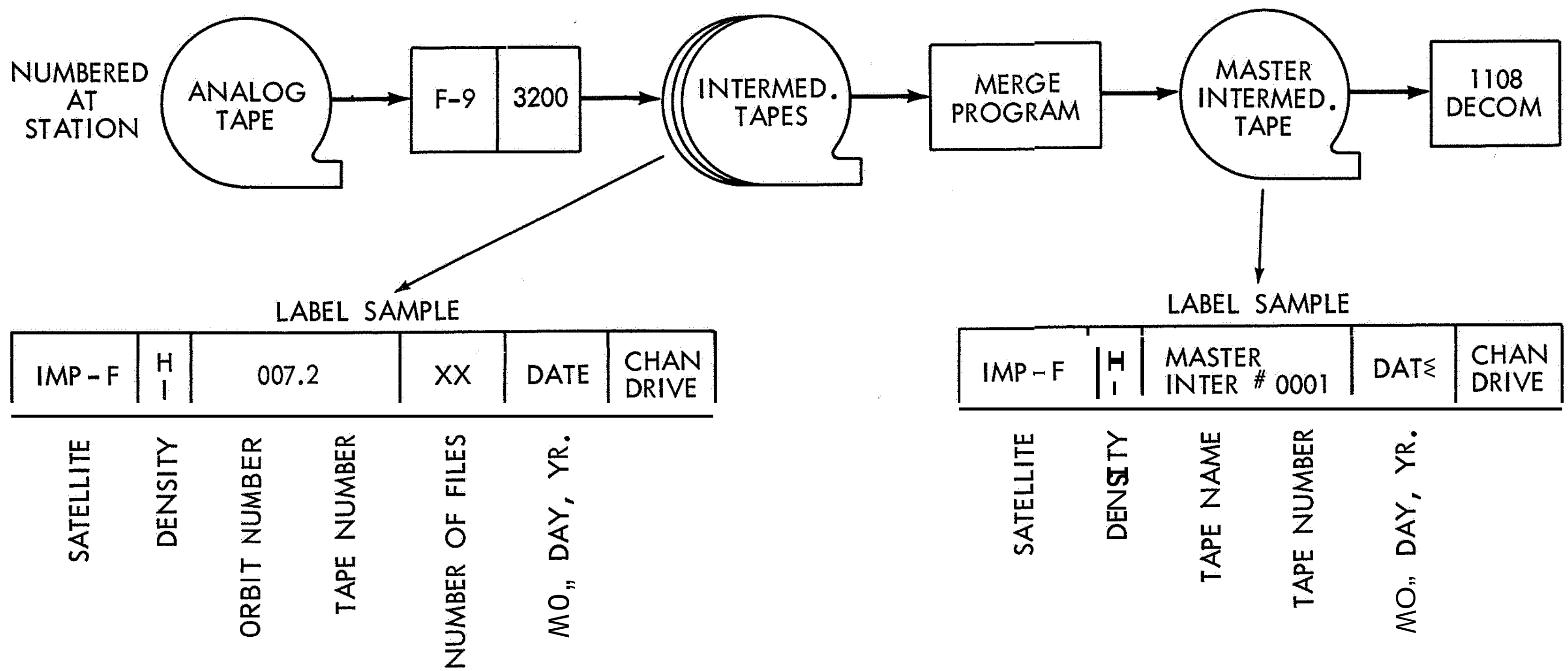
CODE 4 CARD, F-9 LINE The Intermediate Tape (edit tape) will be located as a four digit number in Col. 26-29. Col. 48-52 will carry five zeroes. Example:

Col. 48				Col. 52
0	0	0	0	0

CODE 4 CARD, F-8 LINE The Buffer Tape will be located as a five digit number in Col. 48-52. Example:

Col. 48				Col. 52
0	0	0	0	1

00001 thru 99999



LABEL COLORS: BROWN/WHITE

Figure V-5. Tape Numbering System

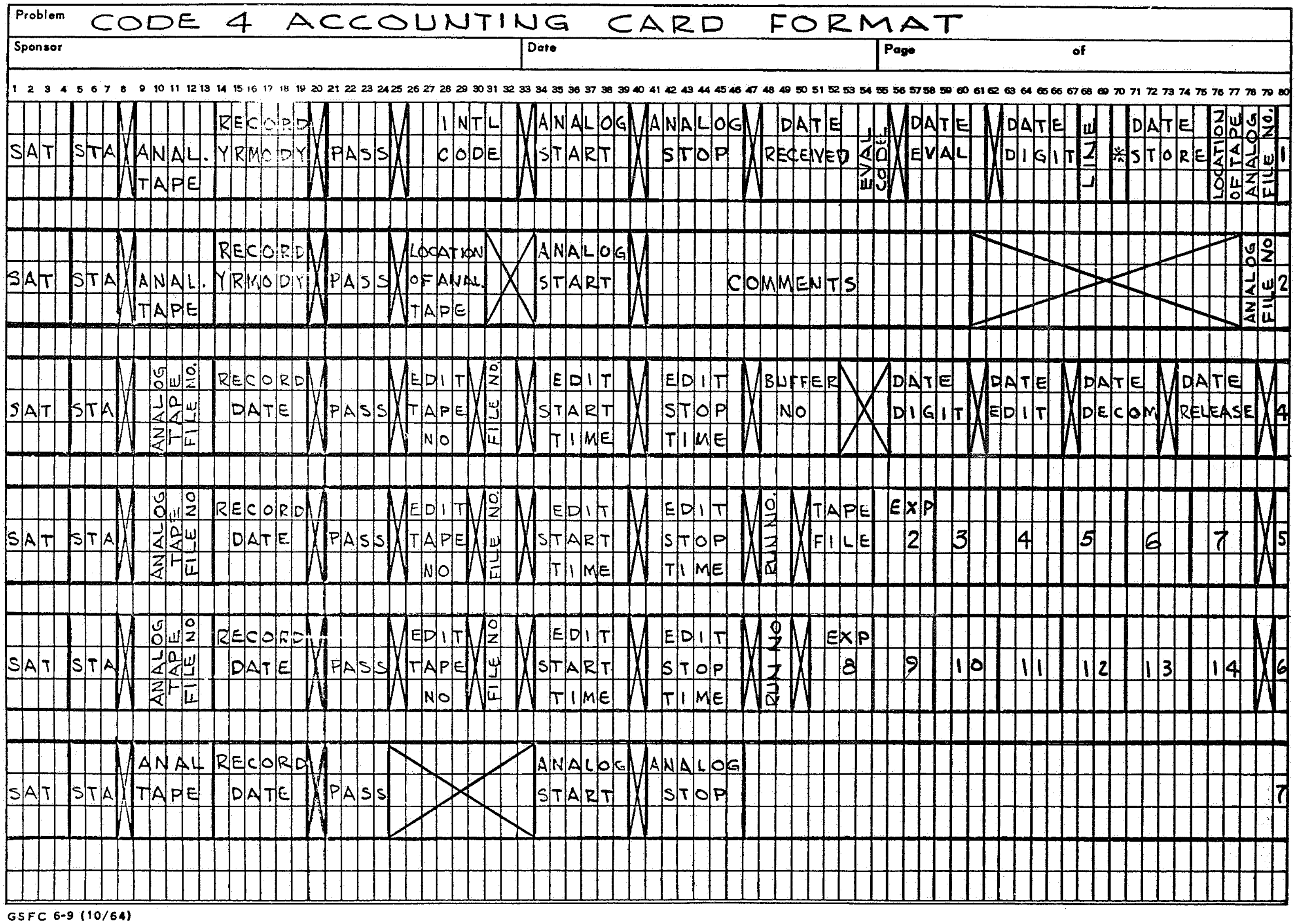


Figure V-6. Code 4 Accounting Card Format

Intermediate Tape Number	No. Files	Operator Initials	Date
1.1			
orbit 1 1.2			
1.3			
2.1			
orbit 2 2.2			
2.3			
3.1			
3.2			
orbit 3 3.3			
3.4 (rerun)			
4.1			
orbit 4 4.2			
4.3			
5.1			
25.1			

Figure V-7. IMP-F Tape Log

ANALOG LIBRARY TAPE REQUEST #________

REQUESTED BY ______ DATE ______ TIME ______ DEL. TO ______

REQUEST NO. ________

OUT	IN
DATE ________	DATE ________
TIME ________	TIME ________
REC'D ________	REC'D ________
DEL'D BY ________	REC'D BY ________

SATELLITE	STATION	TAPE NO.	OUT	IN

560/45 (11/63) GODDARD

Figure V-8. Analog Library Tape Request Form

SATELLITE	STATION	TAPE	DATE DIG.	LINE	CARD	MIN. DATA	SATELLITE	STATION	TAPE	DATE DIG.	LINE	CARD	MIN. DATA

540-22 (1/64)

Figure V-9. Analog Update **List** Form

CODE	STA.	ANALOG TAPE NO.	DATE RECORDED	EDIT NO.	BUFFER TAPE NO.	START TIME	STOP TIME	DATE REJECTED	REMARKS

560-53 (10/63)

Figure V-10. Reject and Delete Daily Log Form

DATE: __/__/____

INTERMEDIATE TAPE NO. ☐

DATA PROCESSING BRANCH

IMP—F

ORBIT NO. ☐

STA. NO.	TAPE NO.	INTER-MEDIATE FILE NO.	ANALOG TIME						PROGRAMS			PROC. SPEED	COMMENTS	OPER. INI-TIALS
			START			STOP								
			HR.	MIN.	SEC.	HR.	MIN.	SEC.	A	D	F-8			

Figure V-11. Intermediate Tape Log Form

INSPECTION **AND**

QUALITY CONTROL

PROCEDURES

6. INSPECTION AND QUALITY CONTROL PROCEDURES

6.1 INTRODUCTION

Primary IMP–F data conversion will be performed by the STARS II F–9 Processor Line. The alternate method of conversion requires the use of the F–8 A/D Line to convert the analog data to a STARS II buffer format which will subsequently be processed by the CDC **3200** Computer. By either method, the STARS II output will consist of an Intermediate Tape (IT), a Quality Control (QC) Summary, and a Computer Console Log. The F–9 conversion may be performed in either of two modes: **(1)** Digital - the primary mode of operation, and **(2)** Analog - the alternate F–9 reduction mode. **A** QC Summary will be outputted from both modes of operation, with the type of mode (Digital or Analog) stated in the heading of the Summary Printout.

These QC Summaries are generated on the Line Printer for various IMP–F programs. In every instance, the summary is considered to be a part of the system output and shall be routed through Dispatch with attendant tapes, cards, and logs. Peculiarities or input signal abnormalities are to be noted at the bottom of the summary by the system operator for all telemetry processing. The notations should clearly indicate the data or processing contingency which may affect the output data–quality.

6.2 DATA INSPECTION

The Data Inspector(s) will receive the QC Summary Printout (Figures VI–1 and VI–2) and a copy of the console logs. From these two sources of information, the data inspector(s) will determine the disposition of a file (accept for decom, redo, send to tape evaluation, or cull the file). The determination of the file disposition will be based on the following criteria:*

A. An analog tape will be sent to Tape Evaluation (TE)** for the following reasons:

1. The Time Flags show that all frames have bad BCD Time.
2. The percent of frame recovery $\frac{\text{Frames Recovered}}{\text{Frames Expected}}$ is $<95\%$.
3. The percentage of Good and Fair samples is $<$ 97%.

---

*These criteria as stated are based on pre-launch predictions and are subject to change when actual data is analyzed.

**For approximately the first two (2) months of operation all analog tapes will be sent to TE for the strip-charting prior to processing through the system.

```
   PROGRAM VERSION APRIL 8,1967              QUALITY CONTROL LISTING FOR IMP F9 DIGITAL SYNC MODE

INTERMEDIATE TAPE FILE NUMBER         06
                                      YHMOOA       HRMNSE                                HRMNSE
          ANALOG START TIME           673014       153120   DIGITAL START TIME           153231                        BCD TIME
          ANALOG STOP TIME                         183800   DIGITAL STOP TIME            172828                     GOOD      BAD
          ANALOG TAPE NUMBER            3206                DIGITAL TAPE NUMBER            04027                    5439        0
ORBIT NUMBER    0001  STATION NUMBER     563        OPERATOR     LMR      TIME  23. 10     OATS   04/17/67
TOTAL SAMPLES RECOVERED       GOOD        FAIR       POOR      UNDETERMINED
              172836       171350          677         5            804
    PERCENT                +99.14%      +.39%      .+0%         +.46%
TOTAL FRAMES RECOVERED                    5431
TOTAL FRAMES EXPECTED                     5042
PERCENT FRAME RECOVERY                 107.71%
          DESCENT       TOTAL SEQUENCES
           +4.12%                       14   ONE ERROR IN 100 OR MORE
          +52.21%                      177   ONE ERROR IN 330
          +35.10%                      119   ONE EQROR IN 500
           +8.55%                       29   ONE EQROR IN 1000 OR LESS
OELTA T EXCEEDED TOLFRANCE               0   TIMES
PHASE SYNC LOST                         32   TIMES
SEQUENCE SYNC LOST                       0   TIMES
PARITY EHROQS
TAPE UNIT-  PQOCESSING       A        RECORDING      TJE6000000
PROCESS NUMBER                  5
FRONT-END MALFUNCTION          YES
```

Figure VI-1. Quality Control Listing For IMP F9 Digital Sync Mode

```
   PROGRAM VERSION 27 MARCH 1967              QUALITY CONTROL LISTING FOR IMP F9 ANALOG MODE

INTERMEDIATE TAPE FILE NUMBER         01
                                      YRMODA       HRMNSE
          ANALOG START TIME           6  500    0  11050   DIGITAL START TIME         11+437                          BCD TIME
          ANALOG STOP TIME                        172000   DIGITAL STOP TIME          155037                       GOOD      BAD
          ANALOG TAPE NUMBER            0000               DIGITAL TAPE NUMBER          11111                        0         62
ORBIT NUMBER     000   STATION NUMBER     563       OPERATOR     LMR       TIME  20. 00     DATE  03/01/67
TOTAL SAMPLES RECOVERED       GOOD      FAIR      POOR      UNDETERMINED
                    0            0         0         0            0
    PERCENT                  .+0%      .+0%      .+0%         .+0%
TOTAL FRAMES RECOVERED                1791
TOTAL FRAMES EXPECTED                11663
PERCENT FRAME RECOVERY              +15.35%
          PERCENT      TOTAL SEQUENCES
           .+0%                    272   ONE ERROR IN 100 OR MORE
           .+0%                      1   ONE ERROR IN 330
           .+0%                      0   ONE ERROR IN 500
           .+0%                      0   ONE ERROR IN 1000 OR LESS
DELTA T EXCEEDED TOLERANCE           0   TIMES
PHASE SYNC LOST                      0   TIMES
SEQUENCE SYNC LOST                   0   TIMES
PARITY ERRORS
TAPE UNIT-  PROCESSING       A       RECORDING     00MPOSCTES
PROCESS NUMBER                 2
FRONT-END MALFUNCTION         NO
```

Figure VI-2. Quality Control Listing For IMP F9 Analog Mode

4. The number of times phase sync and sequence sync are lost is >2% of the number of recovered frames (i.e., 100 times out of 5,000 recovered frames).

5. The number of times Delta T exceeds 2% of the number of recovered frames (i.e., 100 times out of 5,000 recovered frames).

B. An analog tape will be returned for re-do for the following reason:

   1. Backward digital time.

C. An analog tape will be termed unsuitable for decom and culled if found redundant or declared unprocessable.

6.3 LOGS AND FORMS

In general, the Logs and Forms utilized are designed to permit flexible, yet accurate, reporting for all telemetry conversion processes of the many satellite projects. Minor differences in the use of the forms may appear between projects, but the general scheme of data identification and written records is consistent. In all cases, each data form or log is identified as belonging to a specific satellite project by either the satellite name or number, or in this case, IMP-F.

A. Edit Release Forms -

The Edit Release Forms (Figure **VI-3)** are used to indicate the next phase of operation to be performed by the Production Control Center. Upon receipt of the Quality Listings, the Data Inspectors review each file for quality and note on the Edit Release Form the reason for rejection (if any) and the disposition of each file. This release form must also contain the following pertinent information:

1. Project name
2. Date released from Data Inspection
3. Run and I. T. number
4. I. D.'s of rejected file and action to be taken (ok for decom, redo, send to TE, cull)
5. Reason(s) for rejection

B. Reject File Record Form -

The Reject File Record Form (Figure VI-4) with instructions, will be used by the Data Inspectors to indicate the quality-of-data of the rejected file by: station, results of TE, and the next phase of operation performed. The data form must contain the following information and must accompany the suspect tape through the indicated phases of operation:

Project	Date	Edit No.	File No.	ID of Rejected File	Start Time	Reason for Rejection	Date Ship'd	Remarks

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Figure VI-3. Edit Release Form

SATELLITE ID: ____________________

STAT: ____________________ DATE RECORDED: ____________________

ANALOG TAPE #: ____________________ PASS #: ____________________

TRANS. RATE CODE: ____________________

I. Data Inspection

A. Initial Processing — Operator #: ____________________

1. Unprocessable Code: ____________________ Line #: ____________________

Line Tape Unit #: ____________________

2. Reject Code: ____________________

initial Edit #: ____________________ Date Init. Digitized: ____________________

# of Frames Processed: ____________________ # TIMES Sync Lost: ____________________

% of Frames With 0 Errors: ____________________

Digital Start Time: ____________________ Digital Stop Time: ____________________

B. Reprocessing — Operator #: ____________________

Line #: ____________________

Line Taps Unit #: ____________________

Redo. Edit #: ____________________ Data Track: ____________________

Dote Redo.: ____________________ Time Code Used: ____________________

%of Frames With 0 Errors: ____________________ # Times Sync Lost: ____________________

Frames Processed: ____________________ Digital Stop Time: ____________________

Digital Start Time: ____________________

C. Disposition — Accept Initial File ☐

Accept Redo. File ☐ Cull initial File ☐

II. Tope Evaluation

A. Tape Analysis — Analyst: ____________________

	1	2	3	4		1	2	3	4
Signal Levels:					Noise Levels:				
Times Out of Lock: Raw:					Cond.:				

Approx. Bit Error Rate/X Frames:

	1	2	3	4
Raw				
Cond.				

Time Code (Usable or Unusable): BCD: ____________________ SD: ____________________

AGC Analysis: 1 ____________________ 2 ____________________

B. Disposition

Re-digitized: Raw ☐ Cond. ☐ BCD ☐ SD ☐

Do Not Re-digitize: ☐

III. Comments

560-io (3/67) DATA INSPECTION REJECT FILE RECORD

Figure VI-4. Data Inspection Reject File Record Form

1. Station I. D.

2. Analog tape and file number

3. Date recorded and rejected

4. Reason for rejection

5. Selected Quality Listing parameters

6. Date processed in TE and the results of the TE analysis

7. Final disposition

For the files which are declared unprocessable by the operator on the line (DOT Codes, Table VI–1) , Production Control will submit such files to TE on a routine basis and TE personnel will then complete the appropriate section of the reject file form and return said form and tape to Production Control for any further action.

C. Weekly Deletion Record Form -

The Weekly Deletion Record Form (Figure VI-5) will be submitted to the QC Specialist by the Data Inspectors and will be used to indicate the quality–of–data of the rejected files by station and mode. The following information is required on this form:

1. Station I. D. and mode

2. Analog tape I. D.

3. Intermediate Tape I. D.

4. Date processed

5. Line number and operator I. D.

6. Initial data quality results and the redo quality results

7. Delete or reject code (Table VI-2)

8. Elapsed digital time

Table VI-1
Data Processing Unprocessable Codes

The code to be used is as follows:

D - Indicates tape was culled because of data.
O - Indicates tape was culled because of other causes.
T - Indicates tape was culled because of timing deficiencies.

The sub-groups for each main group are:

TIME Code Nos. 1 - 19	DATA Code Nos. 20 - 39	OTHER Code Nos. 40 - 59
1. No time (BCD, SDT, or WWV)	20. No modulation	40. No SDT frequency
2. Time erratic (BCD, SDT, or WWV)	21. Distorted or fading signal	41. No servo
3. Time recorded improperly (BCD, SDT, WWV)	22. Improper recording technique	42. Neither servo nor SDT frequency
4. BCD and SDT agree but no WWV	23. Excessive noise	43. Servo distorted
5. No BCD, SDT does not agree with WWV	24. Poor or no sync	44. SDT frequency won't hold lock
6. No SDT, BCD does not agree with WWV	25. Blank tape	45. Other tape control problems
7. No WWV and BCD does not agree with SDT	26. Improper or changing signal voltage level	46. Tape speed altered during pass
8. BCD and SDT agree, but not WWV	27. Conditioned signal unusable	47. Wrong frequency during pass
9. BCD, SDT, and WWV do not agree	28. Signal-to-noise ratio too low	48. Amplitude of tape control improper
	29. Extraneous modulation on signal	
	30. Not enough data to process	
	31. Constant changing of data rate within a file	

SATELLITE ____________________ WEEK OF ____________________

Station	KBR	Analog Tape No.	Buffer Tape No.	Date Digit.	Line No.	Operator ID	Delete Code	QUALITY DATA						Elapsed Digital Time
								PCT	OER	No. of Frames Processed		LOSYNC		
								Initial	Redo	Initial	Redo	Initial	Redo	

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Figure VI-5. Quality Control Weekly Deletion Record

Table VI-2
Deletion Codes

1. DELETIONS APPLICABLE TO ANALOG-TO-DIGITAL CONVERSION OPERATION:

A. Deletions Based on Ground Time -

DEL 1. Unusable BCD Time

DEL 2. Unusable SD Time

DEL 3. Excessive number of time-flags indicating incorrect time

DEL 4. Excessive number of illegal time-flags

DEL 5. Elapsed time-per-frame does not agree with specified transmission rate

DEL 6. Wrong initial timebase

B. Deletions Due to Obvious STARS-Line Malfunction -

DEL 10. Excessive number of records of incorrect length

DEL 11. Excessive number of records with parity-errors

DEL 12. Improper format (e.g., records do not start at beginning of subcommutator cycle; flags and time-words not in proper location, etc.)

DEL 13. Improper padding-codes to fill-out records

DEL 14. Excessive number of incorrect O-fill in each data-word

DEL 15. Excessive number of illegal data-values

DEL 16. Excessive number of times frame synchronization is incorrectly lost

DEL 17. Excessive number of times frame synchronization is maintained incorrectly.

Table VI-2 (Continued)
Deletion Codes

DEL 18. For PCM data, an excessive number of times that the line-sync bit-error count differs from the actual number of errors present in the sync-word

DEL 19. Excessive number of incorrect flags generated by the line

DEL 20. Excessive number of duplicate values (especially in adjacent data channels)

C. Deletions Due to Obvious Operator Errors -

DEL 30. Incorrect file-label

DEL 31. Missing file-label

DEL 32. Missing end-of-file record

DEL 33. Insufficient number of end-of-file records

DEL 34. Duplicate file on buffer-tape

DEL 35. Entire file missing from buffer-tape

DEL 36. Incorrect line operation-mode

DEL 37. Incorrect tape speed-up factor used

DEL 38. Incorrect file sequence

DEL 39. Improperly splitting one analog file on two buffer-tapes

D. Deletions Due to Questionable Data Quality -

DEL 50. Excessive errors in sync-word (e.g., % of frames with **zero** errors is less than a specified value)

DEL 51. Excessive number of errors in subcommutator channel counter

DEL 52. Excessive bit-slippage

Table **VI-2** (Continued)
Deletion Codes

DEL **53.** Excessive number of errors in a single bit-position of the synchronization-word

DEL **54.** Excessive number of 0 or 1-bit errors in sync-word

PFM Data:

DEL **60.** Overall file-quality less than specified value

DEL **61.** Questionable performance of HRP

DEL **62.** Questionable performance of comb filter

DEL **63.** Excessive number of questionable sequences

DEL **64.** Excessive error-rate in one channel

DEL 65. Excessive error-rate in the same relative frame within all sequences

All Types of Data:

DEL **70.** Excessive number of losses of synchronization

DEL 71. % of data recovered based on digital start-stop time is less than specified value

DEL **72.** % of elapsed digital start-stop time as compared to analog start-stop time is less than specified value

DEL **73.** Insufficient data for experimenters

2. DELETIONS DUE TO OTHER THAN A/D OPERATION

DEL 80. Incorrect input-tapes to computer run

DEL 81. Incorrect input-cards to computer run

DEL **82.** Invalid time-correction

Table **VI-2** (Continued)
Deletion Codes

DEL 83. Redundant file

DEL 84. Unprocessable data content (e.g. , excessive mode-change, subcommutator slips, missing pass turn-on number, erratic spacecraft clock, data out of limits, etc.)

DEL 85. Extraneous file (e.g. , housekeeping data, files deemed unnecessary by the experimenter, etc.)

DEL 86. Late receipt of tape

DEL 87. Unusable film output

D. Quality Control's Monthly Data Processing Report -

Copies of this form (Figure VI-6) will be submitted to the Technical Staff by the Data Inspectors on the 15th of each month.

6.4 QUALITY CONTROL

The Quality Control (QC) Specialist will receive Quality Cards (Figure VI-7) from the Production Control Center, Quality Listings and the aforementioned forms from the Data Inspectors. From these he will analyze the data and establish the quality of the data 1/O to the system, make a continuing check on the overall system, and derive any significant long-term information which may lead to the improvement of the entire system.

The QC Specialist will use the following tools to assist him in his data analysis:

1. Quality Plot Program (QUALPLOT)

   All IT's will be processed through the QUALPLOT program for approximately the first two months of operation or until a valid trend is established. After this point the IT's will be run on an exception basis.

2. Statistical Analysis Program (SASMP)

   This program utilizes the Quality Cards to establish whether there are any significant station differences, operator differences, slant range

Processing Line ________ Project ________ Date ________

Reasons for Deletion	Files Deleted During This Month	Files Deleted Prior To This Month
1.		
2.		
3.		
4.		
5.		
8.		
9.		
10.		
11.		
12.		
Total Number of Files Deleted		

Total number of files processed during this month . . . . ________

Total number of files processed prior to this month . . . . ________

Percentage of processed files released this month . . . . ________

Percentage of processed files deleted this month . . . . ________

Percentage of files processed prior to this month that were released . ________

Percentage of files processed prior to this month that were deleted. . ________

Number of files declaredunprocessable this month. . . . . ________

Number of files declared unprocessable prior to this month . . . . . ________

Number of files deleted once this month . . . . ________

Number of files deleted twice this month . . . . ________

Figure PI-6. Quality Control's Monthly Data Processing Status Report Form

ORIGINAL FORMAT			NEW FORMAT	
Item	Definition	Col's	Definition	Col's
1	SATELLITE I D.	1-4	SATELLITE I D.	1-4
2	STATION I.D.	5-6	STATION I.D.	5-7
3	ANALOG TAPE NO	7-9	ANALOG TAPE NO.	8-11
4	ANALOG FILE NO	10	ANALOG FILE NO	12
5	MIDPOINT OF FILE Y/M/D/H/M	11-19	I. T. NO.	13-16
			MIDPOINT OF FILE Y/M/D/H/M	17-25
6	DIGITAL START TIME	20-24	DIGITAL START TIME	26-30
7	ANALOG OR DIGITAL SYNC MODE (A OR D)	25		
8	% OF FRAMES RECOVERED	26-30	DIGITAL STOP TIME MODE	31-35
9	% OF GOOD DATA POINTS	31-35	% OF FRAMES RECOVERED	37-41
			% OF GOOD DATA POINTS	42-46
10	% OF GOOD & FAIR DATA POINTS	36-40	% OF GOOD & FAIR DATA POINTS	47-51
11	% OF SEQ'S IN BEST PROB. CLASS	41-45	% OF SEQ'S IN BEST PROB. CLASS	52-56
12	% OF SEQ'S IN BEST & NEXT BEST PROB. CLASS	46-50	% OF SEQ'S IN BEST & NEXT BEST PROB. CLASS	57-61
13	LINE ANALOG TAPE UNIT	51	LINE NO	79
	Q	80	Q	80

Figure VI-7. IMP-F Quality Card Format

factors. The Quality cards will be run, using this program, on a time basis (i.e., by orbit, multiple orbits, week, month, etc.).

3. Quality Charts and Graphs

The Q. C. Specialist will keep a record of the data using various charts graphs, and/or tabulations to show any short or long term trends in data Quality. He will report to the DPE any significant trends. A six month quality status report should be turned in to the DPE showing a summary of the up-to-date data analysis.

4. Tape Evaluation Strip Charts

The Q. C. Specialist will meet with the DPE, and whoever else he may designate, to evaluate all analog tape strip-charts. Since TE will strip-chart all tapes for the first two months of operation, weekly evaluation meetings will be held. After this period, strip-chart evaluation meetings will be scheduled when necessary.

6.5 INSTRUCTIONS FOR DATA INSPECTION REJECT FORM

The following instructions are to assist in completing the Reject File Form, (Figure VI-4). This form is to be completed for all files, which either are to be sent to Tape Evaluation or are to be re-digitized due to questionable data-quality or ground-time based on the criteria applied to the edit program printout. This form is not to be used where the file is only to be re-run through the edit program but not re-digitized, or to files which are re-digitized due to obvious line malfunctions or operator errors.

6.5.1 Explanation of Headings

SATELLITE ID: IMP-F
STAT: Station Name and Station Number
DATE RECORDED: Julian Date
ANALOG TAPE #: Self explanatory
PASS #: Number of the pass over the above station, if applicable
TRANS. RATE CODE: For IMP-F, the code is 100 bits per second

I. Data Inspection

A. Initial Processing

1. Unprocessable Code: Use current unprocessable codes

Operator #: Operator ID, operator on A/D Line who processed tape

Line#: A/D Line # (F-8 or F-9)

Line Tape Unit #: The A/D Line tape unit #

2. Reject Code: Use IMP-F reject code

Initial Edit: Edit tape # from the first digitization

Date Init. Digitized: Date of initial digitization

# of Frames Processed: Total # frames processed, taken from edit printout

TIMES Sync Lost: Taken from edit printout

% of Frames With 0 Errors: % of frames with zero sync-bit errors, taken from edit printout

Digital Start Time: Taken from edit printout

Digital Stop Time: Taken from edit printout

B. Reprocessing

Operator #: Operator ID, operator on A/D line who re-digitized analog tape

Line #: A/D line # (F-8 or F-9)

Line Tape Unit #: The A/D line tape unit number used

Redo. Edit #: Edit tape # of re-digitization files

Date Redo: Date of re-digitization

Data Track: Was file re-digitized using the or conditioned data track?

Time Code Used: Was the file re-digitized using the BCD time or SD time?

% of Frames With 0 Errors: % of frames with 0 sync-bit errors

Times Sync Lost: Taken from edit printout

Frames Processed: Total # frames processed from the edit printout

Digital Start Time: Taken from the edit printout

Digital Stop Time: Taken from the edit printout

C. Disposition (check applicable block)

Accept Initial File: Accept the initial digitized file for decom.

Accept Redo. File: Accept the reprocessed file for decom.

Cull Initial File: Cull the initial file.

11. Tape Evaluation

A. Tape Analysis

Analyst: Name of the operator and/or analyst who stripcharted the data and who made the decision as to quality of the data.

Signal Levels: | | | |
1 2 3 4

Indicate the average signal level (by the number of line divisions above the base line) for each quarterly segment of the file.

Noise Levels: | | |
1 2 3 4

Indicate the average noise level (by the number of line divisions above the base line) for each quarterly segment of the file.

Times Out of Lock: Raw: | | | |
1 2 3 4

Cond: | | |
1 2 3 4

Number of times loss of synchronization occurred on the raw data track and the conditioned data track within each quarterly segment of the file.

Approx. Bit Error Rate/X Frames: Raw: | | | |
1 2 3 4

Cond: | | |
1 2 3 4

Estimate the approximate bit error-rate per N frames, where N is the number of frames per printout for the raw and conditioned data track for each of the 4 quarters of the file.

Time Code: BCD: _________ SD: _________

Indicate whether the BCD and the SD times are usable or unusable.

AGC Analysis: 1 and 2 - If applicable, are each of the AGC's good (within nominal range and little change in level), fair (basically good but with several changes in the levels or breaks), or poor (large variations in level, erratic behavior for large portion of the file).

B. Disposition

Re-digitize: Raw ☐ Cond. ☐ BCD ☐ SD ☐

From the above analysis, check the applicable boxes specifying the data and time tracks that should be used for re-digitization.

Do not Re-digitize: ☐

If due to poor data and/or time, this file should not be re-digitized, place a check in this box.

MAINTENANCE

7. MAINTENANCE

7.1 INTRODUCTION

The IMP-F data processing system (F-9/CDC 3200) provides one of the first data reduction systems with self-contained automatic diagnostic capabilities. On previous systems, daily line tests were performed and subsequently required manual interpretation of the limited information, or additional processing time using a computer analysis program. The turnaround time from line-test to line-test interpretation tended to be considerable, and in some cases, costly. The F-9/CDC 3200 diagnostic system is highly versatile and self-contained, yielding immediate status information to the line operator.

A diagnostic package provided with the system allows the line operator to input known data from either a simulator or a test tape and compare every data point with the known test pattern. The operator is provided with a print-out containing sufficient tabulated information to pin-point any abnormalities in sync acquisition, data interpretation, or time tolerance. Thus, there is little, if any, turnaround time.

Additional diagnostic routines are provided to evaluate the processing routines of the F-9/CDC 3200 system. The processing program assigns certain quality information on both data and time in the form of a summary printout. The diagnostic programs provide a means of checking this operation to determine, if in fact, this summary information is reasonable and correct.

Daily utilization of these methods provides rapid and extensive certification of the line's processing status and quickly indicates a "go" or "no-go" situation. In addition to the diagnosis, detailed cross-referenced data is available to the Quality Control personnel for long-term data and system analysis.

The CDC 3200 Computer is checked as a self-contained unit on a daily basis. The time required for this operation is not in conflict with a production shift. If the computer has been certified, a daily line-test of the complete system is made at the beginning of each production shift before any production runs are made. Therefore, once the system has been certified as "go", the possibility of system malfunction, and subsequent loss of data processing time, has been greatly reduced.

In support of the system diagnostics, the line is inspected weekly on a component basis and any necessary adjustments are made. If, at any time, the system fails to be certified, immediate action is taken to remedy the fault. For this task, the maintenance personnel have available a variety of diagnostic routines and procedures to check automatically, or semi–automatically, individual components.

7.2 LINE CERTIFICATION

It is required that a daily line test be performed prior to starting the production run. Standard test tapes will be processed at the speed–up rate that production will be using that day.

The test tape will be processed using the F9SAD diagnosticprogram and the output will be stored on an Intermediate Tape, to be held on the line until the summary printout has been accepted by Quality Control. The intermediate tape may be erased after the summary print has been accepted by Quality Control.

It is also required that on scheduled days certification of the CDC 3200 Computer preventive maintenance be submitted to the cognizant Engineering Representative prior to starting production runs,

All abnormalities in processing will be noted in a log book which will be examined daily by the cognizant Engineering Representative.

All failures of a catastrophic nature will immediately be brought to the attention of the Government representative. The processing line will be shut down until recertified by the Government representative.

APPENDIX

1. NUMBER AND LETTER CODES FOR STADAN AND OTHER STATIONS

TRACKING—TELEMETRY DATA

Number Code	One Letter Code	Three Letter Code	Six Letter Code	TTY Letter Code	Station and Location
			Stadan Stations		
3	D	FTM	FT. MYRS	GYRS	Fort Myers, Florida
5	F	QUI	QUITOE	GQUI	Quito, Ecuador
6	G	LIM	LIMAPU	GAPU	Lima, Peru
8	J	SNT	SNTAGO	GAGO	Santiago, Chile
9	E	PAN	PANTIG	GGNT	Antigua, BWI/ 108MC/
12	L	NFL	NEWFLD	GFLD	St. Johns, Newfoundland
13	M	COL	COLEGE	GLGE	Fairbanks, Alaska
14	N	GFO	GFORKS	GRKS	East Grand Forks, Minnesota
15	P	WNK	WNKFLD	LWNK	Winkfield, England
16	Q	JOB	JOBURG	GBUR	Johannesburg, S. Africa
17	R	MOJ	MOJAVE	JAVE	Goldstone Lake, California
18	S	OOM	OOMERA	AOOM	Woomera, Australia/136MC/
19	T	SKA	ULASKA	GULA	Gilmore Creek, Alaska
20	U	ROS	ROSMAN	GROS	Rosman, North Carolina
21	V	ACT	ORARAL	AACT	Orroral, Australia

Number Code	One Letter Code	Three Letter Code	Six Letter Code	TTY Letter Code	Station and Location
		Stadan Stations (Continued)			
22	W	MAD	MADGAR	LTAN	Madagascar
37	HH	HAW	KAUAIH	AHAW	Kokee, Hawaii
53	XX	KNO	21KNOT	LKNO	Kano, Nigeria
		Jet Propulsion Laboratory Stations			
34	II		OOMJET	AOMJ	Woomera, Australia
40	BB		JETGLD	—	Goldstone Lake, California
41	KK		JOBJET	LJOB	Johannesburg, S. Africa
		Other Stations			
33	DD		CAPCAN	GCPN	Cape Kennedy, Florida
38	JJ	SOL	SOLANT	LALK	South Atlantic
42	LL		MILSTN	—	Millstone, Massachusetts
43	MM	RES	RESBAY		Resolute Bay, N. W. T.
44	NN	PRA	PRALBT		Prince Albert, Saskatchewan
45	PP		JODREL	LJRL	Jodrell Bank, England
46	UU	OTT	OTTAWA		Drte Ottawa, Ontario, Canada
47	RR	BAR	COMMOJ	JMOJ	Barstow, California
48	SS	SNP	SNPORE	LSNP	Singapore
50	QQ		BOULDR		Crpl Boulder, Colorado

Number Code	One Letter Code	Three Letter Code	Six Letter Code	TTY Letter Code	Station and Locations
			Other Stations (Continued)		
56			ASCENS	—	Ascension Island
97		PRE	PRETOR	GPRE	Pretoria, South Africa
98	A1A	CPK	COPARK	CPRK	College Park/RT/ Maryland

2. IMP-F EXPERIMENTER TAPE ADDRESSES

Dr. Charles Roberts
Bell Telephone Laboratories
Murray Hill, New Jersey 07971
Phone: 201-582-4198
Copy of Orbit tapes to BTL

IMP-F Experiment
Low Energy Telescope

Mr. George Pitt
Space Sciences Laboratory
University of California
Berkely, California 94720
Phone: 415-845-6000 x-4054

IMP-F Experiment
Neher Type Ion Chamber

Mr. Leigh Littleton
Enrico Fermi Institute for Nuclear Studies
Chicago, Illinois 60637
Phone: 312-643-0800 x-8532

IMP-F Experiment
Range vs Energy Loss

Mr. W. Stanley
Physics Department
University of Iowa
Iowa City, Iowa 52240
Phone: 319-353-3210

IMP-F Experiment
Low Energy Proton and Electron Differential Energy Analyzer (LEPEDEA)

Dr. Frank R. Allum
Southwest Center for Advanced Studies
P.O. Box 30365
Dallas, Texas 75230
Phone: 214-231-1471 x-270

IMP-F Experiment
Cosmic Ray Anisotropy

Dr. Kenneth McCracken
Department of Physics
University of Adelaide
Adelaide, South Australia, Australia
Send Dupes of SCAS to Dr. McCracken

Mr. Ira M. Green
TRW Systems
R1/1044 E
One Space Park
Redondo Beach, California 90278
'Phone: 213-679-8711 x-67284

IMP-F Experiment
Spherical Electrostatic
Analyzer

Mr. Paul F. Berry
Code 611, Energetic Particles Branch
Goddard Space Flight Center
Greenbelt, Maryland 20771 (APL)
Phone: x-5866 Experiment

IMP-F Experiment
Solar Proton Monitoring

Mr. John L. Wolfgang, Jr.
Code 711
Flight Data Systems Branch
Goddard Space Flight Center
Greenbelt, Maryland 20771
Phone: x-4449

IMP-F Experiment
Radiation Damage

Dr. Keith W. Ogilvie
Fields & Plasmas Branch
Code 612
Goddard Space Flight Center
Greenbelt, Maryland 20771
Phone: x-5904

IMP-F Experiment
Plasma Experiment

Mr. Paul F. Berry
Code 611
Energetic Particles Branch
Goddard Space Flight Center
Greenbelt, Maryland 20771
Phone: x-5866

IMP-F Experiment
(1) Low Energy Proton and
Alpha Detector
(2) Energy vs Energy Loss

Mr. William H. Mish Fields & Plasmas Branch Code 612 Goddard Space Flight Center Greenbelt, Maryland 20771 Phone: x-5444	IMP-F Experiment Magnetic Field Experiment
Mr. John Pyle Flight Data Systems Branch Code 711 Goddard Space Flight Center Greenbelt, Maryland 20771 Phone: x-5929	**OA** and PP Tape
Mr. Paul Butler IMP-F Project Office Code 724 Goddard Space Flight Center Greenbelt, Maryland 20771 Phone: x-4503	OA and PP Printouts
Mr. John Pyle Flight Data Systems Branch Code 711 Goddard Space Flight Center Greenbelt, Maryland 20771 Phone: x-5929	OA and PP Printouts

DATE 220067 PAGE 5

BELL TELEPHONE LABS DECOM DATE 22 JUN 67 ORBIT NO. 3 MASTER DIG. TP BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022050	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41990	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	670612	80161365	899983	00621	56870	11	351	.75	.07	.16	.02	4	3
98	39	1	670612	347684	7201143	493	57178	11	336	.99	.00	.00	.01	5	4

DATE 220067 PAGE 6

UNIVERSITY OF CALIFORNIA DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. . BB4470 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022656	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	670612	80161365	899983	60621	56870	11	351	.75	.07	.16	.02	4	3
98	39	1	670612	347684	7201143	493	57178	11	336	.99	.00	.00	.01	5	4

Mailing List Format

D TE 220067 PAGE 7

UNIVERSITY OF CHICAGO DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4470 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	106938731	13022650	41241	49259	11	4	.99	.00	.00	.01	1	1
98	30	2	670010	172044132	19821372	41990	43307	11	126	.98	.00	.00	.02	2	2
98	38	1	070012	30161365	8999083	00021	56870	11	351	.75	.07	.10	.02	4	3
95	39	1	070012	307084	72011 3	093	57178	11	336	.94	.00	.00	.01	5	4

D TE 220067 PAGE 8

UNIVERSITY OF IOWA DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	3Z	Z	6T0610	10693731	1302205o	41211	49259	11	358	.99	.00	.00	.01	1	1
98	3	2	670610	1T244132	19821ꟷT2	41990	4930T	11	120	.H8	.00	00	.02	2	2
95	3	1	070612	00161365	899983	60621	50370	11	351	.75	.07	.10	.02	4	3
98	39	1	0T001Z	347684	7201143	493	57178	11	336		.00	.00	.01	5	4

Mailing List Format (Continued)

DATE 220067 PAGE 9

SW CENTER FOR ADV STUDIES DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I 5 - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022656	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	670612	80161365	899983	60621	56870	11	351	.75	.07	.16	.02	4	3
98	39	1	670612	347684	7201143	493	57178	11	330	.99	.00	.00	.01	5	4

DATE 220067 PAGE 10

T R W DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 5 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022656	41211	49259	11	358	.90	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	120	.98	.00	.00	.02	2	2
98	38	1	670612	80161305	899983	60621	50870	11	351	.75	.07	.16	.02	4	3
98	39	1	670612	347684	7201143	493	57178	11	330	.99	.00	.00	.01	5	4

Mailing List Format (Continued)

D TE 220667 PAGE 11

APPLIED PHYSICS 4B DECOM DATE 2 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
96	35	2	670610	10698731	18022656	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	126	.98	.00	.00	.02	2	2
96	38	1	670012	80161305	899983	60621	56870	11	351	.75	.07	.16	.02	4	3
98	39	1	670012	347084	7201143	493	57178	11	336	.99	.00	.00	.01	5	4

DATE 220667 PAGE 12

GSFC UNIV. OF MARYLAND DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	SATELLITE CLOCK STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	070010	10098731	18022056	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41990	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	070012	80101305	899983	00621	50870	11	351	.75	.07	.10	.02	4	3
90	39	1	070012	347684	7201143	493	57178	01	336	.99	.00	.00	.01	5	4

Mailing List Format (Continued)

DATE 220667 PAGE 13

GSFC DR HAGGE/DR MCDONALD DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	STOP	INTERMED TAPE No.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022630	41211	49239	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	4930T	11	126	.98	.00	)0	.02	2	2
98	38	1	670612	80161365	899983	60621	50370	11	351	.75	.07	.16	.02	4	3
98	39	1	670612	347084	7201143	493	57173	11	336	.99	.00	.00	.01	5	4

DATE 220067 PAGE 14

RADIATION DAMAGE DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE CLOCK START	STOP	INTERMED TAPE NO.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	070010	10098731	18022650	41211	49259	11	338	.99	.00	.00	.01	1	1
98	36	2	070010	1724413Z	193213T2	41996	49J47	12	120	.98	.00	.00	.02	2	2
98	38	1	070612	80101305	899933	60621	50870	11	351	.75	6	.10	.02	3	3
98	39	1	070012	347034	7201103	493	57178	11	330	69	.00	.00	01	5	3

Mailing List Format (Continued)

DA∩≤ 220ω07 ϖA϶≤ 15

DR. NESS

϶≤COM DATE 22 JUN ω7 ϖϖƎϘT NO. 5 MϖSTEϪ DIG. TP. BBω476 IMP-F

I M ϖ - F QUICK LOO< OωTPUϖ NUMB≤R

STATION NUMBER	ϖNALOG TAP≤	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIM≤ STOP	SATELLIT≤ START	<LOCK ƎΤO.	ϹNT≤ϖM≤D TAP≤ No.	NO. OF SEϖ	ϖϖTϖ ϖUALITY ϖOOD	FϖIR	BϖD	UND≤T	INTEϖ FILE	MDT FIL≤
98	3Ƽ	2	ω70ω10	10ω98731	18ϙ22650	41211	492Ƽ9	11	358	.99	00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	ω70612	8ϙ16130Ƽ	Ǝ99983	60621	5ω87ϕ	11	351	.75	.0Ͽ	.1ω	.02	4	3
98	39	1	ω70612	34Ƽω84	7201143	ω93	ƼϿ178	11	Ƣ3ω	.99	.00	.00	.01	Ƽ	4

DATE 2≡0ω07 ƆϖϖE 1ω

GSFC QA AND PP DATA

DECOM DATE 22 JUN 67 ORBIT NO. 5 MASTER DIG. TP. BB4476 IMP-F

I M P - F QUICK LOOK OUTPUT NUMBER

STATION NUMBER	ANALOG TAPE	DIGITAL PROCESS	RECORD DATE	DIGITAL START	TIME STOP	SATELLITE START	CLOCK STOƆ	INT≤ϖM≤O TAP≤ No.	NO. OF SEQ.	DATA QUALITY GOOD	FAIR	BAD	UNDET	INTER FILE	MDT FILE
98	35	2	670610	10698731	18022656	41211	49259	11	358	.99	.00	.00	.01	1	1
98	36	2	670610	17244132	19821372	41996	49347	11	126	.98	.00	.00	.02	2	2
98	38	1	670612	80161365	899983	60621	56870	11	351	.75	.07	.1ω	.02	4	3
98	39	1	670612	347684	7201143	493	57178	11	33ω	ϭ9	.00	.00	.01	5	4

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